



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

**Division of Facilities Construction and Management**

**DFCM**

## **STANDARD LOW BID PROJECT**

**May 1, 2007**

# **HVAC UPGRADE OGDEN SECOND DISTRICT COURT**

## **ADMINISTRATIVE OFFICE OF THE COURTS OGDEN, UTAH**

DFCM Project No. 06143150

Scott P. Evans Architect and Associates P.C.  
108 West Center Street  
Bountiful, Utah 84010

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov> or are available upon request from DFCM.

DFCM General Conditions dated May 25, 2005.

DFCM Application and Certification for Payment dated May 25, 2005.

Technical Specifications :

Drawings:

**The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>**

# NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

**HVAC UPGRADE – OGDEN SECOND DISTRICT COURT**  
**ADMINISTRATIVE OFFICE OF THE COURTS - OGDEN UTAH**  
**DFCM PROJECT NO. 06143150**

Bids will be in accordance with the Contract Documents that will be available at 10:00 AM on Tuesday, May 1, 2007 and distributed in electronic format only on CDs from DFCM at the Wasatch Building at the Utah State Fairpark, approximately 155 North 1000 West, Salt Lake City, Utah and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Tim K. Parkinson, DFCM Project Manager, at 801-450-2478. No others are to be contacted regarding this bidding process. The construction budget for this project is \$637,000.00

A **mandatory** pre-bid meeting will be held at 10:00 AM on Thursday, May 10, 2007 at the Ogden Second District Court, 2525 Grant Avenue, Ogden Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 1:00 PM on Wednesday, May 23, 2007 at the Wasatch Building at the Utah State Fairpark, approximately 155 North 1000 West, Salt Lake City, Utah. Refer to the map on the DFCM website for directions ([http://dfcm.utah.gov/downloads/fairpark\\_map.pdf](http://dfcm.utah.gov/downloads/fairpark_map.pdf)). Bids will be opened and read aloud in the Wasatch Building at the Utah State Fairpark. NOTE: Bids must be received at the Wasatch Building at the Utah State Fairpark by the specified time.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

Marla Workman, Contract Coordinator

4110 State Office Building, Salt Lake City, Utah 84114

# **PROJECT DESCRIPTION AND QUALIFICATIONS**

## **Description**

Project consists of improvements to the existing HVAC system which includes: additional hot water baseboard heating; Variable Air Volume (VAV) box modifications; addition of VFDs; addition of split-system air conditioning; modifications to supply and return air grilles; and other related improvements. Occupancy sensors will also be added in selected area throughout the facility. Architectural patch and repair to existing finish surfaces shall also be included.

## **Qualifications**

Only qualified Contractors who have had proven experience in all phases of this type of construction and / or who have demonstrated successful completion of similar State Government construction projects will be allowed to submit bids for this project.

A statement of qualifications will be required to be submitted to DFCM prior to the mandatory pre bid meeting by all contractors who have not previously contracted with the State. The statement of qualifications must be specific to this project and include a five-year history of completed similar work projects within the entire scope of work for this particular project including specific projects, results, and references

A management plan will also be required for this project to detail the construction process from the start to finish with tentative schedules and plans to ensure that the quality and timelines of the work will satisfy the owner and the State agency and to be in accordance with all drawings and specifications.

**PROJECT SCHEDULE**

<b>PROJECT NAME:</b> HVAC UPGRADE - OGDEN SECOND DISTRICT COURT ADMINISTRATIVE OFFICE OF THE COURTS – OGDEN, UTAH				
<b>DFCM PROJECT NO.</b> 06143150				
Event	Day	Date	Time	Place
Bidding Documents Available	Tuesday	May 1, 2007	10:00 AM	Wasatch Building Utah State Fairpark Approx 155 North 1000 West Salt Lake City, UT or DFCM web site *
<b>Mandatory</b> Pre-bid Site Meeting	Thursday	May 10, 2007	10:00 AM	Ogden Second District Court 2525 Grant Avenue Ogden UT
Last Day to Submit Questions	Monday	May 14, 2007	1:00 PM	Tim Parkinson – DFCM Email <a href="mailto:tparkins@utah.gov">tparkins@utah.gov</a>
Addendum Issued Responding to Questions (if needed)	Thursday	May 17, 2007	2:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Wednesday	May 23, 2007	1:00 PM	Wasatch Building Utah State Fairpark Approx 155 North 1000 West Salt Lake City, UT **
Sub-contractor List Due	Thursday	May 24, 2007	1:00 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Friday	November 30, 2007	5:00 PM	

\* **NOTE:** DFCM's web site address is <http://dfcm.utah.gov>

\*\* **Due to the ongoing construction on Capitol Hill and the anticipated shortage of parking during 2007, all bids will be received and opened at the Wasatch Building at the Utah State Fairpark. Refer to map on the DFCM web site for directions ([http://dfcm.utah.gov/downloads/fairpark\\_map.pdf](http://dfcm.utah.gov/downloads/fairpark_map.pdf))**



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

**Division of Facilities Construction and Management**

**DFCM**

## BID FORM

NAME OF BIDDER \_\_\_\_\_ DATE \_\_\_\_\_

To the Division of Facilities Construction and Management  
4110 State Office Building  
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **HVAC UPGRADE – OGDEN SECOND DISTRICT COURT – ADMINISTRATIVE OFFICE OF THE COURTS – OGDEN, UTAH – DFCM PROJECT NO. 06143150** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: \_\_\_\_\_

**Base Bid:** For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

\_\_\_\_\_ DOLLARS (\$\_\_\_\_\_)

(In case of discrepancy, written amount shall govern)

**Additive Alternate #1:** Courtroom VFDs - Furnish and install VFDs on the air handling systems to all the courtrooms as indicated on the mechanical drawings and specified in Section 15900

\_\_\_\_\_ DOLLARS (\$\_\_\_\_\_)

(In case of discrepancy, written amount shall govern)

**Additive Alternate #2:** Occupancy Sensors - Furnish and install occupancy sensors to selective rooms as indicated on the electrical drawings.

\_\_\_\_\_ DOLLARS (\$\_\_\_\_\_)

(In case of discrepancy, written amount shall govern)

**Additive Alternate #3:** CO2 Sensors - Furnish and install CO2 sensors where indicated in the mechanical specifications in Section 15900

\_\_\_\_\_ DOLLARS (\$\_\_\_\_\_)

(In case of discrepancy, written amount shall govern)

BID FORM  
PAGE NO. 2

I/We guarantee that the Work will be Substantially Complete by **November 30, 2007** should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$500.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of \_\_\_\_\_

The undersigned Contractor's License Number for Utah is \_\_\_\_\_.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization: \_\_\_\_\_ (Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws: \_\_\_\_\_

Respectfully submitted,

\_\_\_\_\_  
Name of Bidder

ADDRESS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Authorized Signature

# INSTRUCTIONS TO BIDDERS

## 1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

## 2. Bids

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the deadline for submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. **THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.**

If the bid bond security is submitted on a bid bond form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **NOTE: A cashier's check cannot be used as a substitute for a bid bond.**

## 3. Contract and Bond

The Contractor's Agreement will be in the form found in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.



**4. Listing of Subcontractors**

Listing of Subcontractors shall be as summarized in the “Instructions and Subcontractor’s List Form”, which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

**5. Interpretation of Drawings and Specifications**

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM’s web site at <http://dfcm.utah.gov>. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

**6. Addenda**

Addenda will be posted on DFCM’s web site at <http://dfcm.utah.gov>. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

**7. Award of Contract**

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

**8. DFCM Contractor Performance Rating**

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed “DFCM Contractor Performance Rating” form. The ratings issued on this project will not affect this project but may affect the award on future projects.

**9. Licensure**

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

**10. Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

**11. Time is of the Essence**

Time is of the essence in regard to all the requirements of the Contract Documents.

**12. Withdrawal of Bids**

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

**13. Product Approvals**

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

**14. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

**15. Debarment**

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

## BID BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

### KNOW ALL PERSONS BY THESE PRESENTS:

That \_\_\_\_\_ hereinafter referred to as the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, with its principal office in the City of \_\_\_\_\_ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of \$ \_\_\_\_\_ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION IS SUCH** that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the \_\_\_\_\_ Project.

**NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH**, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

**DATED** this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**Principal's name and address (if other than a corporation):**

\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

**Principal's name and address (if a corporation):**

\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Affix Corporate Seal)

**Surety's name and address:**

\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_  
Attorney-in-Fact (Affix Corporate Seal)

STATE OF \_\_\_\_\_ )  
COUNTY OF \_\_\_\_\_ ) ss.

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My Commission Expires: \_\_\_\_\_

Resides at: \_\_\_\_\_

Agency: \_\_\_\_\_  
Agent: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_

NOTARY PUBLIC

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General

**Division of Facilities Construction and****INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

**PROJECTS UNDER \$500,000 - ALL SUBS \$20,000 OR OVER MUST BE LISTED**  
**PROJECTS \$500,000 OR MORE - ALL SUBS \$35,000 OR OVER MUST BE LISTED**

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

**LICENSURE:**

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

**BIDDER LISTING 'SELF' AS PERFORMING THE WORK:**

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

**'SPECIAL EXCEPTION':**

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

**INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**  
**Page No. 2**

**GROUND FOR DISQUALIFICATION:**

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

**CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:**

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

**EXAMPLE:**

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #
ELECTRICAL	ABCD Electric Inc.	\$350,000.00	123456789000
LANDSCAPING	"Self"	300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: 350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

**PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS  
SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.**

**SUBCONTRACTORS LIST**

FAX TO 801-538-3677

PROJECT TITLE: \_\_\_\_\_

Caution: You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: \_\_\_\_\_

DATE: \_\_\_\_\_

SIGNED BY: \_\_\_\_\_

**NOTICE:** FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

# **FUGITIVE DUST PLAN**

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.



**Utah Division of Air Quality**

*April 20, 1999*

**GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A  
DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7**

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.
2. Address or location of your operation or construction site.
3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.
4. Lengths of the project, if temporary (time period).
5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.
6. Type of material processed or disturbed.
7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.
9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).
10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

**Description of Fugitive Dust Emission Activities**  
**(Things to consider in addressing fugitive dust control strategies.)**

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).
2. List type of equipment generating the fugitive dust.
3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.
4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads “on” and “off” property.
5. Vehicle miles travels on unpaved roads associated with the activity (average speed).
6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)
7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

## **Description of Fugitive Dust Emission Controls on Site**

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.
2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).
3. Method of application of dust suppressant.
4. Frequency of application of dust suppressant.
5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).
6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

## **Description of Fugitive Dust Control Off-site**

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place “off” property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).
  
2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary  
Utah Air Quality Board  
POB 144820  
15 North 1950 West  
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000  
FAX: (801) 536-4099

## **Fugitive Dust Control Plan Violation Report**

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the source must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.
2. Time and duration of dust episode.
3. Meteorological conditions during the dust episode.
4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.
5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the source's dust control plan.
6. Reasons for failing to control dust from the dust generating activity or equipment.
7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.
8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

Executive Secretary	Phone: (801) 536-4000
Utah Air Quality Board	FAX: (801) 536-4099
POB 144820	
15 North 1950 West	
Salt Lake City, Utah 84114-4820	

Attachments: DFCM Form FDR R-307-309, Rule 307-309

## CONTRACTOR'S AGREEMENT

FOR:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

THIS CONTRACTOR'S AGREEMENT, made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and \_\_\_\_\_, incorporated in the State of \_\_\_\_\_ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is \_\_\_\_\_.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at \_\_\_\_\_.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

**ARTICLE 1. SCOPE OF WORK.** The Work to be performed shall be in accordance with the Contract Documents prepared by \_\_\_\_\_ and entitled "\_\_\_\_\_"

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

**ARTICLE 2. CONTRACT SUM.** The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of \_\_\_\_\_ DOLLARS AND NO CENTS (\$\_\_\_\_\_.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

CONTRACTOR'S AGREEMENT  
PAGE NO. 2

Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

**ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY.** The Work shall be Substantially Complete by \_\_\_\_\_. Contractor agrees to pay liquidated damages in the amount of \$\_\_\_\_\_ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

**ARTICLE 4. CONTRACT DOCUMENTS.** The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

**ARTICLE 5. PAYMENT.** The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to



safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

**ARTICLE 6. INDEBTEDNESS.** Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

**ARTICLE 7. ADDITIONAL WORK.** It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

**ARTICLE 8. INSPECTIONS.** The Work shall be inspected for acceptance in accordance with the General Conditions.

**ARTICLE 9. DISPUTES.** Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

**ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT.** This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

**ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF.** The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

**ARTICLE 12. INDEMNIFICATION.** The Contractor shall comply with the indemnification provisions of the General Conditions.

**ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT.** The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

**ARTICLE 14. RELATIONSHIP OF THE PARTIES.** The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

**ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT.** Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

**ARTICLE 16. ATTORNEY FEES AND COSTS.** Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

CONTRACTOR'S AGREEMENT  
PAGE NO. 5

**IN WITNESS WHEREOF**, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

**CONTRACTOR:** \_\_\_\_\_

\_\_\_\_\_  
Signature Date

Title: \_\_\_\_\_

State of \_\_\_\_\_ )  
County of \_\_\_\_\_ )

\_\_\_\_\_  
Please type/print name clearly

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me, \_\_\_\_\_, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the \_\_\_\_\_ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

(SEAL)

\_\_\_\_\_  
**Notary Public**

My Commission Expires \_\_\_\_\_

APPROVED AS TO AVAILABILITY  
OF FUNDS:

\_\_\_\_\_  
David D. Williams, Jr. Date  
DFCM Administrative Services Director

**DIVISION OF FACILITIES  
CONSTRUCTION AND MANAGEMENT**

\_\_\_\_\_  
- Manager Date  
Capital Development/Improvements

APPROVED AS TO FORM:  
ATTORNEY GENERAL  
November 30, 2006  
By: Alan S. Bachman  
Asst Attorney General

APPROVED FOR EXPENDITURE:

\_\_\_\_\_  
Division of Finance Date

**PERFORMANCE BOND**  
(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That \_\_\_\_\_ hereinafter referred to as the "Principal" and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, with its principal office in the City of \_\_\_\_\_ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of \_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has entered into a certain written Contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, to construct \_\_\_\_\_ in the County of \_\_\_\_\_, State of Utah, Project No. \_\_\_\_\_, for the approximate sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which Contract is hereby incorporated by reference herein.

**NOW, THEREFORE**, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**WITNESS OR ATTESTATION:**

**PRINCIPAL:**

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_  
(Seal)

Title: \_\_\_\_\_

**WITNESS OR ATTESTATION:**

**SURETY:**

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_  
Attorney-in-Fact (Seal)

STATE OF \_\_\_\_\_ )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My commission expires: \_\_\_\_\_

Resides at: \_\_\_\_\_

\_\_\_\_\_  
NOTARY PUBLIC

**Agency:** \_\_\_\_\_  
**Agent:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General

# PAYMENT BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

## KNOW ALL PERSONS BY THESE PRESENTS:

That \_\_\_\_\_ hereinafter referred to as the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of \_\_\_\_\_, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has entered into a certain written Contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, to construct \_\_\_\_\_ in the County of \_\_\_\_\_, State of Utah, Project No. \_\_\_\_\_ for the approximate sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which contract is hereby incorporated by reference herein.

**NOW, THEREFORE**, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

## WITNESS OR ATTESTATION:

## PRINCIPAL:

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

(Seal)

Title: \_\_\_\_\_

## WITNESS OR ATTESTATION:

## SURETY:

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

Attorney-in-Fact (Seal)

STATE OF \_\_\_\_\_)

) ss.

COUNTY OF \_\_\_\_\_)

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My commission expires: \_\_\_\_\_

Resides at: \_\_\_\_\_

NOTARY PUBLIC

Agency: \_\_\_\_\_  
Agent: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General



## Division of Facilities Construction and Management

## CHANGE ORDER # \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

AGENCY OR INSTITUTION: \_\_\_\_\_

PROJECT NAME: \_\_\_\_\_

PROJECT NUMBER: \_\_\_\_\_

CONTRACT NUMBER: \_\_\_\_\_

ARCHITECT: \_\_\_\_\_

DATE: \_\_\_\_\_

CONSTRUCTION CHANGE DIRECTIVE NO.	PROPOSAL REQUEST NO.	AMOUNT		DAYS	
		INCREASE	DECREASE	INCREASE	DECREASE

	Amount	Days	Date
ORIGINAL CONTRACT			
TOTAL PREVIOUS CHANGE ORDERS			
TOTAL THIS CHANGE ORDER			
ADJUSTED CONTRACT			

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor: \_\_\_\_\_

Date

Architect/Engineer: \_\_\_\_\_

Date

Agency or Institution: \_\_\_\_\_

Date

DFCM: \_\_\_\_\_

Date

Funding Verification: \_\_\_\_\_

Date

Page \_\_\_\_ of \_\_\_\_ page(s)

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**Division of Facilities Construction and Management****DFCM****CERTIFICATE OF SUBSTANTIAL COMPLETION**PROJECT \_\_\_\_\_ PROJECT NO: \_\_\_\_\_  
AGENCY/INSTITUTION \_\_\_\_\_

AREA ACCEPTED \_\_\_\_\_

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at \_\_\_\_\_ (time) on \_\_\_\_\_ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

\_\_\_\_\_

\_\_\_\_\_

The Owner acknowledges receipt of the following closeout and transition materials:

☐ As-built Drawings    ☐ O & M Manuals    ☐ Warranty Documents    ☐ Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of \_\_\_\_\_ (Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

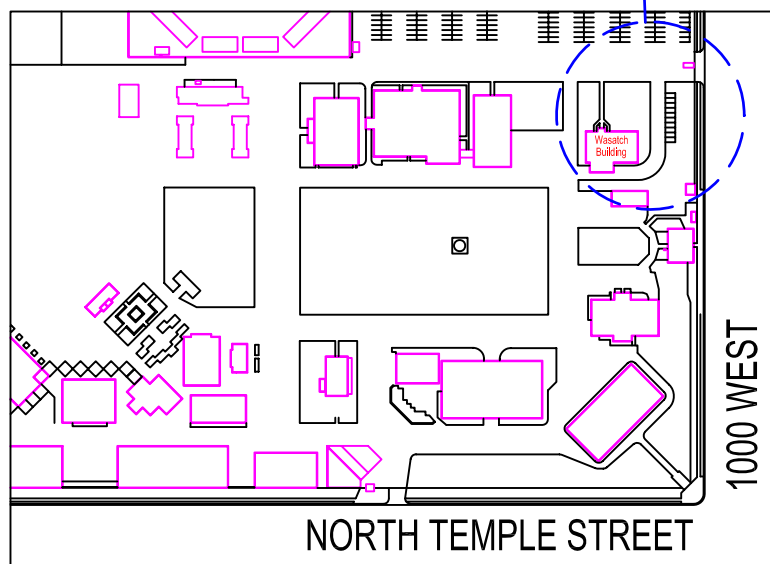
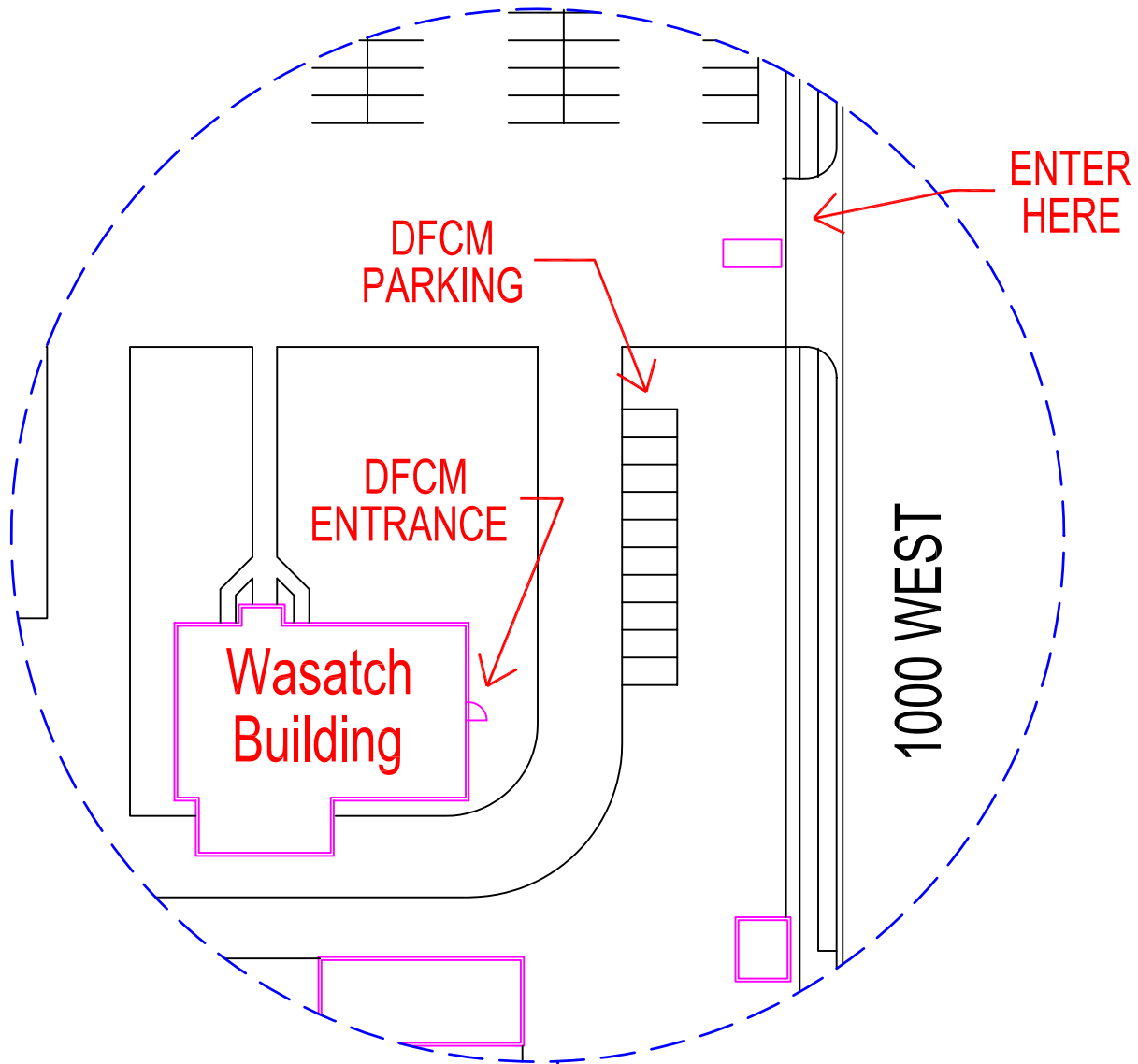
The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within \_\_\_\_\_ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: \$ \_\_\_\_\_. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

\_\_\_\_\_  
CONTRACTOR (include name of firm)      by: \_\_\_\_\_  
(Signature)      DATE

\_\_\_\_\_  
A/E (include name of firm)      by: \_\_\_\_\_  
(Signature)      DATE

\_\_\_\_\_  
USING INSTITUTION OR AGENCY      by: \_\_\_\_\_  
(Signature)      DATE

\_\_\_\_\_  
DFCM (Owner)      by: \_\_\_\_\_  
(Signature)      DATE



UTAH STATE  
FAIR PARK



DFCM Temporary Location



PROJECT MANUAL

OGDEN DISTRICT COURT

HVAC AND ELECTRICAL

IMPROVEMENTS

DFCM PROJECT #06143150

APRIL 24, 2007



State of Utah—Department of Administrative Services

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**DIVISION OF FACILITIES CONSTRUCTION  
AND MANAGEMENT**

4110 State Office Building / Salt Lake City, Utah 84114 / 538-3018



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*"Our Success Is Measured By The Level Of Our Client's Success".*

SCOTT P. EVANS – ARCHITECT & ASSOCIATES P.C.  
108 West Center Street, Bountiful, Utah 84010  
Phone 801-298-1368 Fax 801-298-2192  
E-mail: [info@spe-architect.com](mailto:info@spe-architect.com) Web: [www.spe-architect.com](http://www.spe-architect.com)

# **CONSULTANTS**

## **ARCHITECT**

### **SCOTT P. EVANS – Architect & Assoc. P.C.**

108 West Center Street  
Bountiful, Utah 84010  
(801) 298-1368  
Fax (801) 298-2192  
[www.spe-architect.com](http://www.spe-architect.com)



## **MECHANICAL ENGINEER**

### **VAN BOERUM & FRANK ASSOC.**

330 South 300 East  
Salt Lake City, Utah 84111  
(801) 530-3148  
Fax (801) 530-3150  
[www.vbfa.com](http://www.vbfa.com)



## **ELECTRICAL ENGINEERS**

### **SPECTRUM ENGINEERS**

175 South Main Street  
Salt Lake City, Utah 84111  
(801) 328-5151  
[www.spectrum-engineers.com](http://www.spectrum-engineers.com)



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NOT APPLICABLE

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NOT APPLICABLE

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NOT APPLICABLE

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NOT APPLICABLE

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NOT APPLICABLE

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16130.....	RACEWAYS AND BOXES .....	8
16140.....	WIRING DEVICES.....	4
16140SCH...	WIRING DEVICE SCHEDULE .....	1
16145.....	LIGHTING CONTROL DEVICES.....	4
16410.....	ENCLOSED SWITCHES AND CIRCUIT BREAKERS .....	4
16442.....	PANELBOARDS .....	5
16491.....	FUSES .....	2

## **SECTION 01100 - SUMMARY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Work covered by the Contract Documents.
  - 2. Use of premises.
  - 3. Owner's occupancy requirements.
- B. Related Sections include the following:
  - 1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### **1.3 WORK COVERED BY CONTRACT DOCUMENTS**

- A. Project Identification: **Ogden 2<sup>nd</sup> District Court – HVAC Upgrade**
  - 1. Project Location: **2525 Grant Ave. Ogden, Utah 84401**
- B. Owner: **State of Utah – Division of Construction & Management 4110 State Office Building – Salt Lake City, Utah 84114**
  - 1. Owner's Agency: **Courts**
- C. Architect: **Scott P. Evans – Architect & Associates P.C. – 108 West Center Street, Bountiful, Utah 84010**
- D. The Work consists of the following:
  - 1. The Work includes upgrading the HVAC system and includes some related electrical improvements

#### **1.4 USE OF PREMISES**

- A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.

2. Driveways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
  - a. Schedule deliveries to minimize use of driveways and entrances.
  - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

#### 1.5 OWNER'S OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.
  1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  2. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01100**

## **SECTION 01230 - ALTERNATES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for alternates.

#### **1.3 DEFINITIONS**

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

#### **1.4 PROCEDURES**

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

### **PART 2 - PRODUCTS (Not Used)**

### **PART 3 - EXECUTION**

#### **3.1 SCHEDULE OF ALTERNATES**

- A. Alternate No. 1: **Courtroom VFD's** – Furnish and install VFD's to the air handling systems to all courtrooms as indicated on the mechanical drawings and specified in Section 15900.

- B. Alternate No. 2: **Occupancy Sensors** - Furnish and install occupancy sensors to selective rooms as indicated on the electrical drawings.
- C. Alternate No. 3: **CO<sup>2</sup> Sensors** – Furnish and install CO<sup>2</sup> sensors where indicated in the mechanical specifications Section 15900.

**END OF SECTION 01230**



## **SECTION 01250 - CONTRACT MODIFICATION PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
  - 1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

#### **1.3 MINOR CHANGES IN THE WORK**

- A. Architect will issue Architectural Supplemental Instructions (ASI) authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

#### **1.4 PROPOSAL REQUESTS**

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change. With the cost of the labor include hourly rates that apply.
    - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

#### 1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01250**

## **SECTION 01290 - PAYMENT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
  - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

#### **1.3 DEFINITIONS**

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

#### **1.4 SCHEDULE OF VALUES**

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule. Cost-loaded CPM Schedule may serve to satisfy requirements for the Schedule of Values.
  - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with Continuation Sheets.
    - b. Submittals Schedule.
    - c. Contractor's Construction Schedule.
  - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. Contractor's name and address.

- d. Date of submittal.
- 2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
  - a. Related Specification Section or Division.
  - b. Description of the Work.
  - c. Change Orders (numbers) that affect value.
  - d. Dollar value.
    - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
- 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
- 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  - a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
- 6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
- 8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

#### 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.
- C. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.

2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- D. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- E. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of Values.
  3. Contractor's Construction Schedule (preliminary if not final).
- F. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- G. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01290**

## **SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Coordination Drawings.
  - 2. Administrative and supervisory personnel.
  - 3. Project meetings.
  - 4. Requests for Interpretation (RFI's).
- B. Related Sections include the following:
  - 1. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 2. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

#### **1.3 DEFINITIONS**

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

#### **1.4 COORDINATION**

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
  - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.
  9. Project closeout activities.

## 1.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFI's.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Submittal procedures.
    - j. Preparation of Record Documents.
    - k. Use of the premises and existing building.
    - l. Work restrictions.
    - m. Owner's occupancy requirements.
    - n. Responsibility for temporary facilities and controls.
    - o. Parking availability.

- p. Office, work, and storage areas.
    - q. Equipment deliveries and priorities.
    - r. Progress cleaning.
    - s. Working hours.
  - 3. Minutes: Architect will record and distribute meeting minutes.
- C. Progress Meetings: Conduct progress meetings at biweekly intervals or as agreed upon at the preconstruction meeting. Coordinate dates of meetings with preparation of payment requests.
- 1. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Status of submittals.
      - 2) Quality and work standards.
      - 3) Status of correction of deficient items.
      - 4) Field observations.
      - 5) RFI's.
      - 6) Status of proposal requests.
      - 7) Pending changes.
      - 8) Status of Change Orders.
      - 9) Documentation of information for payment requests.
  - 2. Minutes: Architect will record and distribute to Contractor the meeting minutes.
  - 3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
    - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

#### 1.6 REQUESTS FOR INTERPRETATION (RFI's)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
  - 1. RFI's shall originate with Contractor. RFI's submitted by entities other than Contractor will be returned with no response.
  - 2. Coordinate and submit RFI's in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.



- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
1. Project name.
  2. Date.
  3. Name of Contractor.
  4. Name of Architect.
  5. RFI number, numbered sequentially.
  6. Specification Section number and title and related paragraphs, as appropriate.
  7. Drawing number and detail references, as appropriate.
  8. Field dimensions and conditions, as appropriate.
  9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  10. Contractor's signature.
  11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Software-Generated RFI's: Software-generated form with substantially the same content as indicated above.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFI's received after 1:00 p.m. will be considered as received the following working day.
1. The following RFI's will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFI's or RFI's with numerous errors.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
  3. Architect's action on RFI's that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log biweekly. Use CSI Log Form 13.2B. Include the following: Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFI's that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01310**

## **SECTION 01330 - SUBMITTAL PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
  - 1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
  - 2. Division 1 Section "Closeout Procedures" for submitting warranties.
  - 3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 4. Divisions 2 through 16 Sections for specific requirements for submittals in those Sections.

#### **1.3 DEFINITIONS**

- A. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

#### **1.4 SUBMITTAL PROCEDURES**

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 15 days for initial review of each submittal.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
  3. Include the following information on label for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name and address of Contractor.
    - e. Name and address of subcontractor.
    - f. Name of manufacturer.
    - g. Number and title of appropriate Specification Section.
    - h. Other necessary identification.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
  2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. Transmittal Form: Provide locations on form for the following information:
    - a. Project name.
    - b. Date.
    - c. Destination (To:).
    - d. Source (From:).
    - e. Names of subcontractor, manufacturer, and supplier.
    - f. Category and type of submittal.
    - g. Submittal purpose and description.

- h. Specification Section number and title.
  - i. Drawing number and detail references, as appropriate.
  - j. Transmittal number.
  - k. Submittal and transmittal distribution record.
  - l. Remarks.
  - m. Signature of transmitter.
2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked "Insert approval notation from Architect's (and Construction Manager's) action stamp."
- J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- K. Use for Construction: Use only final submittals with mark indicating "Insert approval notation from Architect's (and Construction Manager's) action stamp" taken by Architect.

## PART 2 - PRODUCTS

### 2.1 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
- 1. Number of Copies: Submit six copies of each submittal, unless otherwise indicated. Architect will not return copies.
  - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- D. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- E. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
- 1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

## **PART 3 - EXECUTION**

### **3.1 CONTRACTOR'S REVIEW**

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### **3.2 ARCHITECT'S ACTION**

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

**END OF SECTION 01330**

## **SECTION 01400 - QUALITY REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
  - 1. Divisions 2 through 16 Sections for specific test and inspection requirements.

#### **1.3 DEFINITIONS**

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### 1.4 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

#### 1.5 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.



- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

## 1.6 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
  2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION 01400**

## **SECTION 01600 - PRODUCT REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
  - 1. Division 1 Section "Alternates" for products selected under an alternate.
  - 2. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
  - 3. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

#### **1.3 DEFINITIONS**

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

#### **1.4 SUBMITTALS**

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
  - 1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
  - 2. Form: Tabulate information for each product under the following column headings:

- a. Specification Section number and title.
    - b. Generic name used in the Contract Documents.
    - c. Proprietary name, model number, and similar designations.
    - d. Manufacturer's name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
    - g. Projected delivery date or time span of delivery period.
    - h. Identification of items that require early submittal approval for scheduled delivery date.
  3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
    - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
  4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
  5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use CSI Form 13.1A.
  2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    - a. Form of Acceptance: Change Order.
    - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."

- b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  - 2. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  - 4. Where products are accompanied by the term "as selected," Architect will make selection.
  - 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
  - 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- B. Product Selection Procedures:
  - 1. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

### 2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 2. Requested substitution does not require extensive revisions to the Contract Documents.
  - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 4. Substitution request is fully documented and properly submitted.
  - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - 7. Requested substitution is compatible with other portions of the Work.
  - 8. Requested substitution has been coordinated with other portions of the Work.
  - 9. Requested substitution provides specified warranty.

### 2.3 COMPARABLE PRODUCTS

- A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01600**



## **SECTION 01700 - EXECUTION REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. General installation of products.
  - 2. Starting and adjusting.
  - 3. Protection of installed construction.
  - 4. Correction of the Work.

### **PART 2 - PRODUCTS (Not Used)**

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

- a. Description of the Work.
  - b. List of detrimental conditions, including substrates.
  - c. List of unacceptable installation tolerances.
  - d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

### 3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

#### 3.4 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

#### 3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

#### 3.6 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.

- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

**END OF SECTION 01700**

## **SECTION 01732 - SELECTIVE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Salvage of existing items to be reused or recycled.
- B. Related Sections include the following:
  - 1. Division 1 Section "Summary" for use of premises and Owner-occupancy requirements.

#### **1.3 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

#### **1.4 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.

#### **1.5 PROJECT CONDITIONS**

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
  - 1. Comply with requirements specified in Division 1 Section "Summary."

- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
  - 1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Arrange to shut off indicated utilities with utility companies.
  - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

- a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

### 3.3 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- B. Removed and Salvaged Items:
  1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
  1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.5 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION 01732**

## **SECTION 01770 - CLOSEOUT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Warranties.
  - 3. Final cleaning.
- B. Related Sections include the following:
  - 1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
  - 2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
  - 3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 4. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 5. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

#### **1.3 SUBSTANTIAL COMPLETION**

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 3. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
  - 4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  - 5. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  - 6. Complete final cleaning requirements, including touchup painting.
  - 7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.



- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
  - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  - 2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
  - 1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
  - 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  - 3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
  - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  - 3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.

#### 1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - c. Remove labels that are not permanent.
    - d. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
      - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

- e. Replace parts subject to unusual operating conditions.
  - f. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Remove waste materials from Project site and dispose of lawfully.

**END OF SECTION 01770**

## **SECTION 01781 - PROJECT RECORD DOCUMENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Product Data.
- B. Related Sections include the following:
  - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
  - 2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

#### **1.3 SUBMITTALS**

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up Record Prints.
- B. Record Product Data: Submit one copy of each Product Data submittal.
  - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

### **PART 2 - PRODUCTS**

#### **2.1 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
  - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Revisions to details shown on Drawings.
    - b. Revisions to electrical circuitry.
    - c. Changes made by Change Order or Construction Change Directive.
    - d. Changes made following Architect's written orders.
    - e. Details not on the original Contract Drawings.
  3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
  3. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 2.2 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders and Record Drawings where applicable.

## 2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## **PART 3 - EXECUTION**

### **3.1 RECORDING AND MAINTENANCE**

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

**END OF SECTION 01781**

## **SECTION 06105 - MISCELLANEOUS CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Rooftop equipment bases and support curbs.
  - 2. Wood blocking, cants, and nailers.
  - 3. Plywood backing panels.
- B. Related Sections include the following:
  - 1. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

#### **1.3 DEFINITIONS**

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  - 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 3. Provide dressed lumber, S4S, unless otherwise indicated.

### 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC2.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  - 4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
  - 5. Wood floor plates that are installed over concrete slabs-on-grade.

### 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Use Exterior type for exterior locations and where indicated.



3. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
  4. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking.
  2. Plywood backing panels.

## 2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
  2. Nailers.
  3. Rooftop equipment bases and support curbs.
  4. Cants.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content of any species.
- C. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

## 2.5 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

## 2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.

- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.7 METAL FRAMING ANCHORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Simpson Strong-Tie Co., Inc.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
  - 1. Use for interior locations where stainless steel is not indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports, unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
- G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
  - 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
  - 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
  - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.
- J. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

### 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

### 3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

**END OF SECTION 06105**

## **SECTION 07510 - BUILT-UP ROOFING (Patching)**

### **1.00 GENERAL**

1.01 All applicable provisions of General and Supplementary General Conditions and Special Conditions, form a part of this section of Specifications.

#### **1.02 DESCRIPTION OF WORK**

##### **A. Scope:**

1. The extent of built-up roofing patch system work is indicated on drawings and by provisions of this section, and is defined to include roofing, composition flashings, stripping and roofing accessories integrally related to roofing installation.
2. Related work specified elsewhere.
  - a. Roof related rough carpentry: Section 06100.
  - b. Roof related sheet metal: Section 07600.

##### **B. System Description:**

1. System shall consist of a patching a gravel-surfaced four-ply asphalt applied membrane system at the location of the new curbs for the mechanical equipment.

#### **1.03 QUALITY ASSURANCE**

A. The Contractor shall provide primary products, including each type of roofing membrane (felt) and insulation produced by a manufacturer which has been producing these types of products successfully for not less than three (3) years and shall provide secondary products which are acceptable to manufacturers of primary products.

B. Governing Standards: Provide built-up roofing system and component materials which have been tested for application and slopes indicated and comply with applicable standards of the following organizations:

1. Underwriters Laboratories, Inc. (UL) for Class A external fire exposure.
  - a. Provide roof covering materials bearing Classification Marking (UL) on bundle, package or container indicating that materials have been produced under UL's Classification and Follow-up Service.
2. Factory Mutual, minimum Wind Uplift Classification of I-90.
3. Uniform Building Code, latest edition.
4. National Roofing Contractors Association (NRCA)
5. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
6. American Society for Testing and Materials (ASTM)
7. American Roofing Manufacturers Association (ARMA)
8. RIC-TIMA

E. Conflicts of Governing Standards: If conflicts occur between any listed governing standards, or between listed standards and Construction Documents, comply with the most expensive, stringent, limiting or explicit requirement as judged by the Architect.

1. Refer any conflicts to Architect for direction before proceeding.

F. Quality of Installation: Requirements for Quality of Work are intended for procurement of manufacturer's highest grade product for type of roofing system indicated. All work shall meet or exceed manufacturer's latest published requirements which would qualify for a 20 year labor and material "No Dollar Limit" guarantee.

1. Patching of the existing roof shall not void the existing roof warranty.

#### 1.04 APPLICATOR REQUIREMENTS

A. Applicator shall be currently approved and licensed by the manufacturer of the roofing materials to be used. Applicator shall use only skilled roofers completely familiar with the products and the manufacturer's current recommended methods of installation.

B. Except as modified and supplemented herein, applicator shall follow the published requirements and written recommendations of the manufacturer of the built-up roof system and other materials manufacturers. Concerning methods of installation, industry practices apply only when this contract does not address the matter.

C. If, in the option of the Contractor, any work is indicated on the drawings or specified in such manner as to make it impossible to produce work of highest quality, or should discrepancies appear from one drawing to another, or between drawings and specifications, the Contractor shall advise the Architect before proceeding.

#### 1.06 SUBMITTALS

A. Applicator shall submit manufacturer's products specifications, installation instructions and general recommendations for each principal roofing system product required. He shall include data substantiating that materials comply with requirements including certificates and delivery logs for bulk materials, and records on field testing for bitumen softening point, flash point, equiviscous temperature (EVT), and finished blowing temperature. This certification is to be obtained prior to commencement of application and with each subsequent asphalt shipment to be given to the quality control inspector to use for determination of proper asphalt heating and application requirements.

B. Within thirty (30) days after award of contract, and before any membrane roofing materials are delivered to the job site, applicator shall submit to the Architect a copy of a letter from the roofing materials manufacturer stating that the roofing contractor is an approved applicator of the materials to be used in the application of the roof system.

C. Upon completion of all work listed under this section and as a written condition of its acceptance, applicator shall deliver to the Owner a written guarantee, stating that all roof leaks which occur during a two (2) year period from completion of the roof will be repaired in a quick and satisfactory manner.

#### 1.07 PRODUCT HANDLING

A. The Contractor shall be responsible for the following:

1. Deliver all roof system materials in original, unopened manufacturer-labeled packages with bitumen bills of lading to show manufacturer, bitumen softening point, EVT, finish blowing temperature and flash point, with each delivery. All rolled roofing products shall bear Underwriter Laboratories (U.L.) labels.
2. Store all roof system materials in enclosed trailers. When stored on the roof deck overnight, store rolled materials on end and on pallets. Totally cover materials stored outside using a breathable covering (such as canvas). Extend covering down to the pallet so that no materials

remain exposed and properly secure to resist wind uplift. Visqueen or other non-breathable plastic coverings will not be accepted. Unprotected, moist or otherwise damaged materials or materials with evidence of moisture damage, such as staining, will be conspicuously marked for permanent removal from the job. Store emulsions in temperatures above 40 degrees F. Handle rolled goods with care to prevent damage to edges or ends.

3. The materials can be stored close to the building, but should not block any entrance ways. Access to the building will be verified and coordinated with the Owner.
4. Select and handle material handling equipment to avoid damage to materials, existing construction or applied roofing.
5. Use only kettles and/or tankers that have automatic thermostats to control the bitumen temperature. They must also have accurate thermometers that are clean and easy to read.
6. All materials will be inspected for conformance to specifications. Materials found that are not approved or do not meet required standards will be marked as rejected and permanently removed from the job site.
7. Do not allow bitumen to be heated above the finished blowing temperature. In the event that asphalt is heated above the finished blowing temperature, discontinue application until asphalt is allowed to cool to an acceptable temperature. Asphalt that is heated above the finished blowing temperature beyond four hours shall be discarded and not used for the built-up roof system.
8. Do not load or permit any part of a structure to be loaded with a weight that will endanger its safety or cause damage. Confine equipment, storage of materials and debris, and the operation and movements of workmen within the limits as indicated or as directed by the Owner.
9. Verify that all materials are protected before, during and after arrival at the job site. Verify that all materials have been adequately protected from moisture damage while in transit.

#### 1.08 JOB CONDITIONS

##### A. Environmental Requirements:

1. Wind velocity limitation will be based on ability to apply materials in specified manner, except no work will be permitted when wind chill factor is below 20 degrees F.
2. Do not apply materials when ambient temperature is below 0 degrees F. and special precautions are required when ambient temperature is below 40 degrees F.

##### B. Protection:

1. Protect building contents and grounds during the process of the work. Protect all paving and building adjacent to hoist, kettle and stinger pipe prior to starting work. Windows, doorways, walkways, landscaping, sprinkling systems, etc. may require special protection measures.
2. Remove all debris daily from the roof. Use enclosed chute crane and bucket, or construction hoist to minimize dust, dirt and noise.
3. Provide 15-pound minimum size fire extinguisher using amonium phosphate fire-fighting agent. Locate two at each kettle, tanker and site of hot bitumen application on the roof.
4. Provide special protection or avoid heavy traffic on completed work when ambient temperature

exceeds 80 degrees F.

5. Contractor must take every precaution to prevent interior leakage, materials falling into the interior, or other such occurrence. Installation of materials shall be accomplished in such a manner that BITUMEN DRIPPAGE DOES NOT OCCUR.
6. The Contractor shall prevent access by the public to materials, tools or equipment. The Owner assumes no liability or responsibility whatsoever for any damage, destruction, theft or other acts which may occur to the Contractor's materials or equipment as a result of his negligence.

#### 1.09 REGULATORY REQUIREMENTS

A. Conform to regulations of public agencies including any specific requirements of the City of jurisdiction and the State of Utah.

#### 1.10 GUARANTEES

A. The Contractor shall guarantee the installation of roofing and flashing to be watertight for a period of two (2) years from the date of substantial completion of the building of structure. The Contractor shall make all repairs during this two-year period to maintain the roof watertight and in conformance with these specifications without additional cost to the Owner. At the end of the guarantee period, the Contractor shall make a final inspection of the roof. All blisters, bubbles, bare spots and other defects shall be repaired by the Contractor at his own expense. The Owner has the right, in the case of emergency at any time during this two-year period and without invalidating this guarantee, to make any temporary repairs that are required in order to protect the building and the contents of the building from damage due to the roof leaking.

### 2.00 PRODUCTS

#### 2.01 MATERIALS

##### A. ACCEPTABLE MANUFACTURERS

1. All membrane roofing materials shall be manufactured by one of the following approved manufacturers:
  - a. Johns Manville Corporation
  - b. Celotex
  - c. GAF Corporation
  - d. Intec/Permaglas
  - e. Tamko
2. Built-up roofing is to be class A fire retardant.

##### C. AGGREGATE SURFACE

1. Aggregate: Certified ASTM D 1863, 3/8 - inch gravel or Heckett Type C Slag.

##### D. SHEET MATERIALS

1. Glass Ply Felt - ASTM D 2178, Type IV.
2. Woven Glass Fabric - ASTM D 1668, Type I.



3. Flashing Sheet - Modified Bitumen SBS Type.

#### E. BITUMINOUS MATERIALS

1. Asphalt Bitumen - ASTM D 312-78, Type II or III for interply mopping.
2. Asphalt Primer - STM D 41.
3. Plastic Roof Cement - ASTM D 2822-75.
4. Flashing Cement - ASTM D 2822-75, FS SS-C-153, Type I.
5. Fibrated Aluminum Coating - ASTM D 2824-76, Type III.

#### F. CANTS

1. At vertical junctures - 45 degree angle or the configuration detailed, preformed asphalt impregnated wood fiber board cant strip - ASTM C 208 only where fiber cant specifically shown on drawings. Wood cants are a part of the work of Division 6.

#### G. FASTENERS

1. Base Flashing to Wood Members: 1.5-inch barbed roofing nails through one-inch metal discs.

#### H. ELASTOMERIC SEALANT

1. Shall conform to Federal Specification No. TT-S-00230C and/or TT-S-001543A.

### **3.00 EXECUTION**

#### 3.01 ROOF PREPARATION

A. No new built-up roofing will be applied until the deck is inspected and approved by the Quality Controller and/or Architect.

B. Inspection:

1. Verify deck is clean and smooth, free of depressions, waves or projections properly sloped to drains.
2. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips, wood nailing strips and reglets are in place.
3. Verify deck surfaces are dry and free of snow or ice.

C. Commencement of roofing application over any section will denote acceptability by the Contractor of that section and he will be responsible for any corrective work which may be occasioned by his having started over an unsatisfactory surface.

D. Clean all surfaces of debris, and of any moisture before proceeding with application of the roofing material.

### 3.02 ROOF INSTALLATION

A. Contractor shall apply four plies of fiberglass Type IV roofing felt over the complete insulation system in the following manner, (all four plies to be installed in same day):

1. Starting at the low point of the roof, apply one nine-inch wide strip, cover the first strip with an 18-inch wide strip, over both strips apply one 27-inch wide strip, then over all three, apply a full 36 inch wide fiberglass Type IV roofing felt. Following plies are to be applied full width, overlapping the preceding felt by 27.5 inches in such a manner that at least four plies of felt cover the insulation at any point.
2. Lightly broom each ply of felt into place, full width, while the bitumen is hot and fluid. Felts shall lay flat and fully bonded, in such a manner that in no area shall felt touch felt. Use only a squeegee or conduit type broom.

E. Contractor shall adhere to the following guidelines:

1. Roofing materials shall not be installed during inclement weather.
  - a. Roofing materials shall not be applied when moisture in any form, such as dew, can be seen or felt on the surface to which those materials are to be applied.
  - b. Materials shall not be applied when foaming, blistering, or bubbling of the hot bitumen occurs.
2. Interply moppings of hot (at EVT) asphalt shall be continuous and applied at the rate of 25 pounds (minimum) per square. Application methods shall insure that all plies are completely embedded in asphalt. All bitumen shall be steep asphalt, Type III, 190 deg. F. softening point.
3. Temperatures at the kettle shall be controlled so that bitumen temperature shall not exceed the asphalt manufacturer's maximum finished blowing temperature.
4. All insulation must be covered with the completed roof membrane system at the end of each day's work. All roof terminations and openings shall be watersealed.
5. Staging of the roof membrane application or temporary membrane is not acceptable. Membrane shall be installed in final form on a day-to-day basis.
  - a. If phased roofing occurs as a result of emergency conditions, install additional plies over phased areas so that a continuous four-ply system is installed.
6. Thermostatic controls and visible thermometer shall be provided on tanker and/or kettle, maintained in working order and calibrated.
7. Foot and wheeled traffic shall be kept off the newly installed membrane until asphalt has sufficiently cured to prevent displacement voids.
8. All membrane deficiencies such as voids, bridging, fishmouths, cuts, tears, etc., shall be repaired in an acceptable manner. Incorporate into such repairs as many plies as are affected by the deficiency.
9. Air void pockets, as determined by test samples, shall not exceed 8% per interply mopping for individual sample and average of all samples shall be less than 5% per interply mopping.

F. Apply the gravel surfacing over the completed membrane unless otherwise indicated as follows:

1. Flood the entire surface with Type III asphalt at a rate of 60 pounds per square and while it is still hot, embed therein 3/8-inch gravel at a rate of 400 pounds per roof square. Double flood and gravel at exterior corners in a 10 foot by 10 foot area. No crushed gravel.
2. If necessary, dry aggregate, by heating or other methods, to meet the specified ASTM requirements. Store and maintain in the specified dry condition until embedded in the surfacing asphalt.
3. Gravel should be fairly rounded in shape and should contain a minimum of flat, sharp, or elongated particles.
4. At the time of application, the gravel shall be hard, durable, opaque, surface dry, and free of clay, loam, sand, or other foreign substances.
5. Storage piles of gravel shall be placed on coated or graveled portions of the membrane and not on bare felts.
6. If stored on the ground, gravel shall be placed onto a ground covering in order to prevent contamination from ground debris.

G. Bitumen Heating Requirements shall be as follows:

1. Maximum asphalt temperature in heating equipment:
  - a. Asphalt shall not be heated to the minimum flashpoint.
  - b. The minimum finished blowing temperature shall not be exceeded for more than a total of four hours, for any asphalt batch or portion thereof.
  - c. Remove from project any asphalts heated above these limits.
2. Temperature at time and point of application:
  - a. All asphalts to be within 25 deg. F. of their equiviscous temperature when applied in the roof system.
  - b. Asphalts not meeting this criteria are to be reheated or allowed to cool, as required.
3. Rate of bitumen application:
  - a. Insulation: 33 pounds per 100 square feet.
  - b. Interply moppings for membrane, and over insulation: 23 pounds per 100 square feet for asphalt, with tolerances of -15% and +25%.
  - c. Flood Coat: 60 pounds per 100 square feet of asphalt for slopes less than 1/2:12, 60 pounds per 100 square feet of asphalt for slopes equal to, or greater than 1/2:12. Flood coat applicator must slow down mini-mop, pour can, etc. to achieve 60 lb. requirement. Bitumen temp for flood coat should be lowered to bottom end of EVT requirement. Remove all chains from mini-mop when applying flood coat.

### 3.03 FLASHING INSTALLATION

A. General Flashing Specifications:

1. All flashings must be completed daily, no staged flashing application will be allowed; however, base flashing may be delayed until completion of built-up roof so long as plastic cement is troweled at top of felt terminations at cant area as a temporary waterseal.
2. All other flashings not specifically detailed herein will be applied in accordance with Manufacturer's Specifications and approved by the Owner or Owner's representative.
3. All sheet metal that will come in contact with bituminous materials shall be primed with an asphalt primer and allowed to dry before applying bitumen.

B. Contractor shall install base flashings at the base of vertical wall and curb surfaces which abut the built-up roof as follows:

1. Prime all walls with asphaltic primer applied at one (1) gallon per 100 square feet.
2. Install 4" x 4" fiberboard cants at the juncture of all vertical surfaces and roof. Cants may be nailed or embedded into hot steep asphalt.
3. Embed one (1) ply of #15 fiberglass felt into hot steep asphalt, (only over wood surfaces).
4. Embed one (1) ply of a modified Bitumen flashing sheet Torch-on-Type. The flashing sheet shall be of sufficient width to extend from the top edge of the flashing a minimum of four inches onto the roof.
5. Do not extend the base flashing less than eight inches nor more than 10 inches up the wall.
6. Fasten the top edge of the base flashing approximately every four inches on center with appropriate fasteners through one-inch diameter tin discs.
7. Seal the top edge of the flashing with woven fiberglass flashing fabric (six inches wide) embedded into and covered over with asphaltic plastic (flashing grade) roof cement, centered over the top edge of the base flashing.
8. All vertical laps shall be covered with a four-inch wide strip of flashing fabric embedded in, and troweled over with asphaltic plastic (flashing grade) roof cement, bringing the cement to a feather edge. This also includes corner.
9. Completely bond all flashing to the underlying surface. Completely bond the flashing plies to each other without any looseness, bubbles or voids. Remove and replace any loose flashings.
10. Coat the completed base flashing and crickets where noted with a fibrated aluminum coating.

3.05 CLEAN-UP

A. Contractor shall remove bituminous markings from finished surfaces. In areas where finished surfaces are soiled by asphalt or any other source, caused by work of this Section, he shall consult manufacturer of surfaces for cleaning advice and conform to instructions.

B. Contractor is to keep the roof and premises clean and free of accumulations of waste materials and rubbish at all times. He shall remove all debris, scrap, and rubbish from the work area daily. He shall not

throw or drop material from the roof; he is to use fixed chutes to slide materials, or other means to prevent injury or damage to personnel, equipment, building or premises.

### 3.06 FINAL INSPECTION

A. Prior to acceptance of roof system, an inspection shall be made by the Roofing Contractor, General Contractor and Owner's Representative and consultants to determine if the roof has been installed according to Contract Documents. A punch list shall be prepared and all deficiencies shall be corrected prior to final acceptance of the work performed.

B. The above work shall be completed according to a substantial completion time limit specified.

**END OF SECTION 07510**

## **SECTION 07620 - SHEET METAL FLASHING AND TRIM**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Formed Products:
    - a. Formed equipment support flashing.
- B. Related Sections:
  - 1. Division 6 Section " Miscellaneous Carpentry" for wood nailers, curbs, and blocking.
  - 2. Division 7 Section "07510" for installing sheet metal flashing and trim integral with roofing.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Fabricate and install copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
  - 1. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft.: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
1. Identification of material, thickness, weight, and finish for each item and location in Project.
  2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  4. Details of termination points and assemblies, including fixed points.
  5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
  6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
  7. Details of special conditions.
  8. Details of connections to adjoining work.
  9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

## PART 2 - PRODUCTS

### 2.1 SHEET METALS

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  2. Surface: Smooth, flat.
  3. Exposed Coil-Coated Finish:

### 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
    - b. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

## 2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
  - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 2. Obtain field measurements for accurate fit before shop fabrication.
  - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.



- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

## 2.4 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 0.028 inch thick.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

### 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
  - 5. Install sealant tape where indicated.
  - 6. Torch cutting of sheet metal flashing and trim is not permitted.
  - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

### 3.3 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

### 3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

### 3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 07620**

## **SECTION 09260 - GYPSUM BOARD ASSEMBLIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Interior gypsum wallboard.
  - 2. Non-load-bearing steel framing.
  - 3. Shaft-wall systems
- B. Related Sections include the following:
  - 1. Division 6 Section "Rough Carpentry" for wood framing and furring.

#### **1.3 DEFINITIONS**

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.

#### **1.5 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory."
- B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
  - 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

### 1. Steel Framing and Furring:

- a. Clark Steel Framing Systems.
- b. Consolidated Systems, Inc.
- c. Dale Industries, Inc. - Dale/Incor.
- d. Dietrich Industries, Inc.
- e. MarinoWare; Division of Ware Ind.
- f. National Gypsum Company.
- g. Scafco Corporation.
- h. Unimast, Inc.
- i. Western Metal Lath & Steel Framing Systems.

### 2. Gypsum Board and Related Products:

- a. American Gypsum Co.
- b. G-P Gypsum Corp.
- c. National Gypsum Company.
- d. United States Gypsum Co.

## 2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 754 for conditions indicated.
- B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- C. Hangers: As follows:
  - 1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
  - 1. Depth: 2 inches.
- E. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
  - 1. Cold Rolled Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange, 3/4 inch deep.
  - 2. Steel Studs: ASTM C 645.
    - a. Minimum Base Metal Thickness: As indicated.
    - b. Depth: As indicated.
  - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: 0.0312 inch.

## 2.3 STEEL PARTITION AND SOFFIT FRAMING

- A. Components, General: As follows:
  - 1. Comply with ASTM C 754 for conditions indicated.
  - 2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
- B. Steel Studs and Runners: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0312 inch.
  - 2. Depth: As indicated.
- C. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base Metal Thickness: 0.0312 inch.
- E. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.
  - 1. Depth: As indicated.
  - 2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0312 inch.
  - 2. Depth: As indicated.
- G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.

- H. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

## 2.4 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Wallboard: ASTM C 36.
  - 1. Type X:
    - a. Thickness: 5/8 inch.
    - b. Long Edges: Tapered.
    - c. Location: As indicated.
- C. Flexible Gypsum Wallboard: ASTM C 36, manufactured to bend to fit tight radii and to be more flexible than standard regular-type panels of the same thickness.
  - 1. Thickness: 1/4 inch.
  - 2. Long Edges: Tapered.
  - 3. Location: Apply in double layer at curved assemblies.

## 2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
  - 2. Shapes:
    - a. Cornerbead: Use at outside corners, unless otherwise indicated.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.

4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

2.7 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

- a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
- b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been

installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

### 3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
  2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
    - a. Use deep-leg deflection track where indicated.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

### 3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.



3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
  4. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  5. Do not attach hangers to steel deck tabs.
  6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.
- C. Sway-brace suspended steel framing with hangers used for support.
- D. Screw furring to wood framing.
- E. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.
- F. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
1. Hangers: 48 inches o.c.
  2. Carrying Channels (Main Runners): 48 inches o.c.
  3. Furring Channels (Furring Members): 16 inches o.c.

### 3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs 1/2 inch short of full height to provide perimeter relief. Do not fasten studs to top track to allow independent movement of studs and track.
  2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
    - a. Terminate partition framing at suspended ceilings where indicated.
- D. Install steel studs and furring at the following spacings:
1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.

- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
- F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
  - 1. Install two studs at each jamb, unless otherwise indicated.
  - 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
  - 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

### 3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.
- I. Form control and expansion joints with space between edges of adjoining gypsum panels.
- J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed

by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

- K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- L. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
- M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
  - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
- O. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

### 3.7 PANEL APPLICATION METHODS

- A. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
- B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Tile Backing Panels:
  - 1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.
  - 2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
  - 3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.8 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

### 3.9 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
  - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
  - 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for acoustical tile.
  - 3. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
  - 4. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated.

### 3.10 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
  - 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
  - 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
    - a. Installation of 80 percent of lighting fixtures, powered for operation.
    - b. Installation, insulation, and leak and pressure testing of water piping systems.
    - c. Installation of air-duct systems.
    - d. Installation of air devices.
    - e. Installation of mechanical system control-air tubing.
    - f. Installation of ceiling support framing.

**END OF SECTION 09260**

## **SECTION 09912 - PAINTING (PROFESSIONAL LINE PRODUCTS)**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes surface preparation and field painting of exposed interior items and surfaces.
- B. Related Sections include the following:
  - 1. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

#### **1.3 DEFINITIONS**

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
  - 1. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
  - 2. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
  - 3. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

#### **1.4 SUBMITTALS**

- A. Product Data: For each paint system indicated. Include block fillers and primers.
  - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Samples for Initial Selection: For each type of finish-coat material indicated.
  - 1. After color selection, Architect will furnish color chips for surfaces to be coated.

#### **1.5 QUALITY ASSURANCE**

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

- B. Source Limitations: Obtain primers (where occurs) for each coating system from the same manufacturer as the finish coats.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.
  - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

## 1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Benjamin Moore & Co. (Benjamin Moore).
  - 2. Kelly-Moore Paint Co. (Kelly-Moore).
  - 3. PPG Industries, Inc. (Pittsburgh Paints).
  - 4. Sherwin-Williams Co. (Sherwin-Williams).

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
  - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: As selected by Architect from manufacturer's full range.

## 2.3 INTERIOR PRIMERS

- A. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
  - 1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
  - 2. Kelly-Moore; 971 Acry-Prime Interior Latex Primer/Sealer: Applied at a dry film thickness of not less than 1.6 mils.
  - 3. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
  - 4. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

## 2.4 INTERIOR FINISH COATS

- A. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
  - 1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils.
  - 2. Kelly-Moore; 1610 Sat-N-Sheen Interior Latex Low Sheen Wall and Trim Finish: Applied at a dry film thickness of not less than 1.6 mils.
  - 3. Kelly-Moore; 1686 Dura-Poxy Eggshell Acrylic Enamel: Applied at a dry film thickness of not less than 1.6 mils.
  - 4. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils.
  - 5. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
  - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.



- B. **Scheduling Painting:** Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  2. Omit primer over metal surfaces that have been shop primed and touchup painted.
  3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. **Application Procedures:** Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. **Brushes:** Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
  2. **Rollers:** Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
  3. **Spray Equipment:** Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. **Minimum Coating Thickness:** Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. **Mechanical and Electrical Work:** Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. **Prime Coats:** Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- G. **Pigmented (Opaque) Finishes:** Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- H. **Stipple Enamel Finish:** Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- I. **Completed Work:** Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

### 3.4 CLEANING

- A. **Cleanup:** At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

### 3.5 PROTECTION

- A. Protect existing furnishings and other finishes. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
  1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.6 INTERIOR PAINT SCHEDULE

- A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
  1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.
    - a. Primer: Interior gypsum board primer.
    - b. Finish Coats: Interior low-luster acrylic enamel.

**END OF SECTION 09912**

## **SECTION 09265 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Shaft enclosures.
- B. Related Sections include the following:
  - 1. Division 9 " Gypsum Board Assemblies" for applying and finishing panels in gypsum board shaft-wall assemblies.

#### **1.3 DEFINITIONS**

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Structural Performance:
  - 1. Provide gypsum board shaft-wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.
  - 2. Provide gypsum board shaft-wall assemblies for horizontal duct enclosures capable of spanning distances indicated within deflection limits indicated.
  - 3. Air-pressure loads and deflection limits are specified in "Gypsum Board Shaft Wall" Article in Part 2.

#### **1.5 SUBMITTALS**

- A. Product Data: For each gypsum board shaft-wall assembly indicated.
- B. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft-wall assembly's required fire-resistance rating.

1. Include data substantiating that elevator entrances and other items that penetrate each gypsum board shaft-wall assembly do not negate fire-resistance rating.
- C. Research/Evaluation Reports: Evidence of compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction that substantiate required fire-resistance rating for each gypsum board shaft-wall assembly.
- D. Acoustical-Test-Response Reports: From a qualified independent testing agency substantiating required STC rating for each gypsum board shaft-wall assembly.

## 1.6 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory."
- B. STC-Rated Assemblies: For gypsum board shaft-wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Management and Coordination." Review methods and procedures for installing work related to gypsum board shaft-wall assemblies including, but not limited to, the following:
  1. Fasteners proposed for anchoring steel framing to building structure.
  2. Sprayed fire-resistive materials applied to structural framing.
  3. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.
  4. Wiring devices in shaft-wall assemblies.
  5. Doors and other items penetrating shaft-wall assemblies.
  6. Items supported by shaft-wall-assembly framing.
  7. Mechanical work enclosed within shaft-wall assemblies.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

## 1.8 PROJECT CONDITIONS

- A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Division 9 Section " Gypsum Board Assemblies."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: The design for gypsum board shaft-wall assemblies is based on products named in Part 2 "Gypsum Board Shaft Wall" Article. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
  - 1. American Gypsum Co.
  - 2. G-P Gypsum Corp.
  - 3. National Gypsum Company.
  - 4. United States Gypsum Co.

### 2.2 ASSEMBLY MATERIALS

- A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
  - 1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
  - 2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.
- B. Steel Framing: ASTM C 645.
  - 1. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating.
- C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.
- D. Gypsum Wallboard: ASTM C 36, core type as required by fire-resistance-rated assembly indicated.
  - 1. Edges: Tapered and featured (rounded or beveled) for prefilling.
- E. Gypsum Base for Gypsum Veneer Plaster: ASTM C 588, core type as required by fire-resistance-rated assembly indicated, with edges as standard with manufacturer.
- F. Water-Resistant, Gypsum Backing Board: ASTM C 630/C 630M, core type as required by fire-resistance-rated assembly indicated.
- G. Cementitious Backer Units: ANSI A118.9, in manufacturer's standard thickness, but at least 1/2 inch thick.

- H. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 9 Section " Gypsum Board Assemblies " that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.
- I. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Division 9 Section "Gypsum Board Assemblies."
- J. Gypsum Veneer Plaster Joint-Reinforcing Materials: ASTM C 587 and as specified in Division 9 Section "Gypsum Veneer Plaster."
- K. Gypsum Veneer Plaster: As specified in Division 9 Section "Gypsum Veneer Plaster."
- L. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- M. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
  - 1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
  - 2. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with capability to sustain, without failure, a load equal to 5 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 488.
- N. Acoustical Sealant: As recommended by gypsum board shaft-wall assembly manufacturer for application indicated.
- O. Sound Attenuation Blankets: ASTM C 665 for Type I, unfaced mineral-fiber-blanket insulation produced by combining thermosetting resins with mineral fibers manufactured from slag or rock wool.

### 2.3 GYPSUM BOARD SHAFT WALL (See Drawings for Shaft Wall location and Type)

- A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing and inspecting agency.
- B. Intermittent Air-Pressure Loads: 5 lbf/sq. ft..
- C. Deflection Limit: L/360.
- D. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.

1. Depth: As indicated.
  2. Minimum Base Metal Thickness: As indicated.
- E. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches, in depth matching studs.
1. Minimum Base Metal Thickness: As indicated - Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
- F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than thickness - as indicated on UL # on drawings.
- G. Room-Side Finish: As indicated.
- H. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.
- I. STC Rating: As indicated.
- J. Cavity Insulation: Sound attenuation blankets (Only if Mechanical requires sound Attenuation)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 7 Section "Sprayed Fire-Resistive Materials."
1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
  2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

### 3.3 INSTALLATION

- A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
  - 1. ASTM C 754 for installing steel framing.
  - 2. Division 9 Section " Gypsum Board Assemblies " for applying and finishing panels.
- B. Do not bridge building expansion joints with shaft-wall assemblies; frame both sides of joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
  - 1. At elevator hoistway (if shown) door frames, provide jamb struts on each side of door frame.
  - 2. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.
- D. Integrate stair hanger rods with gypsum board shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.
- E. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- G. Install control joints to maintain fire-resistance rating of assemblies.
- H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.
- I. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 2 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- thick, gypsum board cants covering tops of projections.
  - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft-wall framing.
  - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to the shaft-wall framing.

**END OF SECTION 09265**



DIVISION 15 - MECHANICAL

SECTION 15100  
MECHANICAL REQUIREMENTS

GENERAL CONDITIONS:

The General Conditions of the Contract, with the amendments, supplements, forms and requirements in Division 1, and herewith made a part of this Division.

All sections of Division 15 shall comply with the Mechanical General Requirements. The standards established in this section as to quality of materials and equipment, the type and quality of workmanship, mode of operations, safety rules, code requirements, etc., shall apply to all sections of this Division as though they were repeated in each Division.

SCOPE OF WORK:

The project described herein is Ogden 2<sup>nd</sup> District Courts HVAC Upgrade, Ogden 2<sup>nd</sup> District Court Building, Ogden, Utah. This work shall include all labor, materials, equipment, fixtures, and devices for the entire mechanical work and a complete operating and tested installation as required for this project.

Section 15100 MECHANICAL REQUIREMENTS  
Section 15150 BALANCING, MAINTENANCE MANUALS, AND IDENTIFICATION  
Section 15300 PIPING SYSTEMS, SPECIALTIES AND VALVES  
Section 15700 HEAT TRANSFER SYSTEMS  
Section 15800 AIR DISTRIBUTION, HEATING AND AIR CONDITIONING  
Section 15900 AUTOMATIC TEMPERATURE CONTROL SYSTEM

SYSTEM DESCRIPTION:

This project consists of several parts intended to improve the operation of the HVAC system. These parts include but are not limited to:

1. Convert the existing pneumatic vav box controllers and reheat valves, radiant heating valves and air handler valves to DDC control.
2. Add supplemental cooling to several areas. Supplemental cooling to be split, dx, type air conditioning units. Condensing units will be located on the roof.
3. Rebalance the building HVAC systems as described herein.
4. Test, repair and/or upgrade ductwork where indicated on drawings.
5. Replace the existing heating pumps and provide variable speed control for pumps.
6. Add building static pressure control.
7. Add ATC smoke rated dampers at various locations.
8. Add additional radiant heating.

2 9. Add vfd control to air handling unit supply and return fans

4 10. Add CO2 control of the ventilation air for the air handling units.

6 **BID FORM LINE ITEMS.**

8 The contractor shall identify the bid price for each of the following line items. The bid prices listed shall cover  
the item in its entirety include all components, supports, labor, controls, warranties, etc. These line item  
bid prices shall be submitted with the contractors bid.

10 1. Vfd control of the supply fans and return fans for the constant volume air handling units.

12 \$ \_\_\_\_\_

14 2. VAV control connections to occupancy sensors(coordinate with electrical)

16 \$ \_\_\_\_\_

18 3. CO2 control for the ventilation air for the air handling units.

\$ \_\_\_\_\_

20 **CODES & ORDINANCES:**

22 All work shall be executed in accordance with all underwriters, public utilities, local and state rules and  
24 regulations applicable to the trade affected. Should any change in the plans and Specifications be required  
to comply with these regulations, the Contractor shall notify the Architect before the time of submitting his  
26 bid. After entering into contract, the Contractor will be held to complete all work necessary to meet these  
requirements without extra expense to the Owner. Where work required by drawings or specifications is  
28 above the standard required, it shall be done as shown or specified.

30 Applicable codes are as follows:

32 Current Utah Boiler and Pressure Vessel Rules and Regulations

34 2006 International Mechanical Code

2006 International Building Code

2006 International Plumbing Code

2006 Fuel and Gas Piping Code

2006 International Energy Conservation Code

38 **UTILITIES & FEES:**

40 Contractor is responsible to obtain all permits and fee information for this project.

42 All charges for fees and permits will be paid by the owner. Unless noted otherwise, all systems furnished and  
44 or installed by this Contractor, shall be complete with all utilities, components, commodities and accessories  
required for a fully functioning system.

46 **Authorities Having Jurisdiction**

48 Contractor is responsible to contract and coordinate all inspections required by the various agencies who  
50 are authority having jurisdiction. Inspection must be completed and documented before substantial  
completion is given to contractor. Examples are: Boiler Inspector, Water Heaters, Air Compressors.

## SUBMITTALS AND SHOP DRAWINGS:

### Submittals:

As soon as possible after the contract is awarded, the Contractor shall submit to the Architect six (6) copies of the descriptive literature covering products and materials to be used in the installation of mechanical systems for this project. The review of the submitted data will require a minimum of 14 days. If the Contractor's schedule requires return of submitted literature in less than the allotted time, the Contractor shall accelerate his submittal delivery date. The Contractor shall resubmit all items requiring re-review within 14 days of returned submittals. Refer to each specification section for items requiring submittal review. Written approval of the Owner's Representative shall be obtained before installing any such equipment or materials for the project. The submittals shall be prepared in an orderly manner, contained in a 3-ring loose-leaf binder with index and identification tabs each item or group of items and for each specification section. All items shall be submitted at one time except automatic temperature control drawings and seismic restraint drawings which may be submitted separately within 30 days of the contract award date. Partial submittals will not be reviewed until the complete submittal is received.

Submitted literature shall bear the Contractor's stamp, indicating that he has checked all equipment being submitted; that each item will fit into the available space with the accesses shown on the drawings; and, further, that each item conforms to the capacity and quality standards given in the contract documents.

Submitted literature shall clearly indicate performance, quality, and utility requirements; shall show dimension and size of connection points; and shall include derating factors that were applied for each item of equipment to provide capacity at job site elevation. Temperature control submittals shall include piping and wiring diagrams, sequence of operation and equipment. Equipment must fit into the available space with allowance for operation, maintenance, etc. Factory piped and wired equipment shall include shop drawings for all internal wiring and piping furnished with the unit.

Submitted literature shall clearly show all required field install wiring, piping, and accessory installations required by the Contractor to provide a complete operating system.

Review by the Owner's Representative is for general conformance of the submitted equipment to the project specification. In no way does such review relieve this Contractor of his obligation to furnish equipment and materials that comply in detail to the specification nor does it relieve the Contractor of his obligation to determine actual field dimensions and conditions that may affect his work. Regardless of any items overlooked by the submittal review, the requirements of the contract drawings and specifications must be followed and are not waived or superseded in any way by the review.

By description, catalog number, and manufacturer's names, standards of quality have been established by the Architect and the Engineer for certain manufactured equipment items and specialties that are to be furnished by this Division. Alternate products and equipment may be proposed for use only if specifically named in the specifications or if given written prior approval in published addenda. Design equipment is the equipment listed on the drawings or if not listed on the drawings is the equipment first named in the specifications.

Shop drawings shall be submitted for review prior to the installation of any equipment.

### Alternate Equipment:

The Contractor should protect himself with the supplier of alternate named equipment. Alternate named equipment will be reviewed only one time.

Should alternate equipment be submitted and be rejected, it shall not be resubmitted for review and it shall be the responsibility of this contractor. The contractor shall only submit on design equipment on future submittals. Incomplete submittal data will be rejected.

If the Engineer is required to do additional design work to incorporate changes caused by submitting equipment or products, different than the design equipment specified, as defined above, the contractor shall reimburse the engineer for additional time and expenses at the engineers current, recognized, hourly rates.

#### DRAWINGS AND MEASUREMENTS:

##### Drawings:

The contract document drawings show the general design, arrangements, and extent of the system. In certain cases, the drawings may include details that show more nearly exact locations and arrangements; however, the locations, as shown diagrammatically, are to be regarded as general.

It shall be the work of this Section to make such slight alterations as may be necessary to make adjustable parts fit to fixed parts, leaving all complete and in proper shape when done. All dimensions given on the drawings shall be verified as related to this work and with the Architect's office before work is started.

This Section shall carefully study building sections, space, clearances, etc., and then provide offsets in piping or ductwork as required to accommodate the building structure without additional cost to the Owner. In any case and at any time, a change in location required by obstacles or the installation of other trades not shown on the mechanical plans shall be made without charge.

The drawings shall not be scaled for roughing in measurements nor shall they be used as shop drawings. Where drawings are required for these purposes or where drawings must be made from field measurements, the Contractor shall take the necessary measurements and prepare the drawings. Shop drawings of the various subContractors shall be coordinated to eliminate all interferences and to provide sufficient space for the installation of all equipment, piping, ductwork, etc.

The drawings and specifications have been prepared to supplement each other and they shall be interpreted as an integral unit with items shown on one and not the other being furnished and installed as though shown and called out on both.

##### Record Drawings:

Record drawings for all systems and sections of this Division shall be furnished as work of this Section. Black-line white prints of floor plans shall be furnished by the Architect's office. These prints shall be accurately and neatly marked in colored pencil, showing all changes from schematics.

These drawings shall be reviewed with the Architect at least once each month, shall be submitted at time of final inspection, and shall be checked for accuracy. Failure to keep record drawings up-to-date shall be cause for withholding monthly payments.

#### CONTRACTOR'S USE OF BUILDING EQUIPMENT:

The Contractor may use equipment such as electric motors, fans, heat exchangers, filters, etc., with the written permission of the Owner. As each piece of equipment is used (such as electric motors and fans), maintenance procedures approved by the manufacturer are to be followed. A careful record is to be kept of the length of the time the equipment is used, maintenance procedures followed, and any difficulty

encountered. The record is to be submitted to the Owner upon acceptance. All fan belts and filter media (such as bearings) shall be carefully inspected just prior to acceptance. Any excessive wear noted shall require replacement.

#### EQUIPMENT CAPACITIES:

Capacities shown for equipment in the specifications and on the drawings are the minimum acceptable. No equipment shall be considered as an alternate which has capacities or performance less than that of design equipment.

All equipment shall give the specified capacity and performance at the job-site elevation of 4400 feet above sea level. Manufacturers' standard ratings shall be adjusted accordingly. All capacities and performances listed on drawings or in specifications are for job-site conditions.

#### SEISMIC REQUIREMENTS FOR EQUIPMENT:

All equipment must be furnished structurally adequate to withstand seismic forces as outlined in the International Building Code for the applicable seismic zone. Equipment bases shall be designed for direct attachment of seismic snubbers and/or seismic anchors.

#### COOPERATION WITH OTHER TRADES:

The Contractor shall refer to other drawings and parts of this specification that cover work of other trades that is carried on in conjunction with the mechanical work such that all work can proceed without interference resulting from lack of coordination.

The Contractor shall properly size and locate all openings, chases, sleeves, equipment bases, and accesses. He shall provide accurate wiring diagrams to the Electrical Contractor for all equipment furnished under this Division.

The ceiling cavity must be carefully reviewed and coordinated with all trades. In the event of conflict, the installation of the mechanical equipment and piping shall be in the following order: plumbing, waste, and soil lines; supply, return, and exhaust ductwork; water piping; medical gases; fire protection piping; and pneumatic control piping.

The mechanical Contractor shall insure that the installation of all piping, ducts and equipment is in compliance with Articles 110-16 and 384-4 of the National Electrical Code relative to proper clearances in front of and over all electrical panels and equipment. No piping or ductwork will be allowed to run over electrical panel.

#### RESPONSIBILITY OF CONTRACTOR:

The Contractor is responsible for the installation of a satisfactory piece of work in accordance with the true intent of the drawings and specifications. He shall provide, as a part of his work and without expense, all incidental items required even though these items are not particularly specified or indicated. The installation shall be made so that its several component parts will function together as a workable system and shall be left with all equipment properly adjusted and in working order. The Contractor shall familiarize the Owner's Representative with maintenance and lubrication instructions as prepared by the Contractor and shall explain and fully instruct him relative to operating, servicing, and maintenance of them.

#### PIPE AND DUCT OPENINGS AND EQUIPMENT RECESSES:

Pipe and duct chases, openings, and equipment recesses shall be provided by others only if shown on architectural or structural drawings. All openings for the mechanical work, except where plans and specifications indicate otherwise, shall be provided as work of this Division.

Whether chases, recesses, and openings are provided as work of this Division or by others, this Contractor shall supervise their construction and be responsible for the correct size and location even though detailed and dimensioned on the drawings. This Contractor shall pay for all necessary cutting, repairing, and finishing if any are left out or incorrectly made. All necessary openings thru existing walls, ceilings, floors, roofs, etc. shall be provided by this Contractor unless indicated otherwise by the drawing and/or specifications.

#### UNFIT OR DAMAGED WORK:

Any part of this installation that fails, is unfit, or becomes damaged during construction, shall be replaced or otherwise made good. The cost of such remedy shall be the responsibility of this Division.

#### WORKMANSHIP:

Workmanship shall be the best quality of its kind for the respective industries, trades, crafts, and practices, and shall be acceptable in every respect to the Owner's representative. Nothing contained herein shall relieve the Contractor from making good and perfect work in all details in construction.

#### SAFETY REGULATION:

The Contractor shall comply with all local and OSHA safety requirements in performance with this work. (See General Conditions). This Contractor shall be required to provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

#### ELECTRICAL SERVICES:

##### Motors:

All motors required under this Division shall be furnished and installed as work of this Division. All motor-starting equipment, unless otherwise specified in Division 15 shall be furnished as work of Division 16, Electrical. Motors shall be name plated with Class F insulation as manufactured by Lincoln Electric, US Motors, General Electric, Allis Chalmers, Century, or Reliance, designed for quiet continuous operations with maximum (Class B) 90°C resistance heating rise with 40°C ambient temperature at full load and rated speed and voltage individually specified with minimum 1.15 service factor. Motors shall be all of the same make except those incorporated in packaged units. All motors shall be provided with ball bearings and conduit connection boxes. Lifting eyes shall be provided on motors 1-1/2 horsepower and larger.

The Mechanical Contractor shall furnish and set all motors, shall give the exact locations of all electrical connections, and shall provide complete information on motor control to the Electrical Contractor. The Mechanical Contractor shall be responsible for the proper operation of all electrical power equipment furnished by him.

Unless otherwise specified, motors 3/4 horsepower and larger shall be 3 phase, 60 cycle, and motors 1/2 horsepower and smaller shall be single phase, 60 cycle. Refer to fan and equipment schedules on drawings for voltage characteristics, horsepower, size, etc. All single-phase motors shall have thermal overload protection. If motor-starting equipment is included in packaged units, all three phases shall have overload protection. All motors shall have a power factor of 85 percent or better. All motors 20 horsepower and larger shall be manufacturers Premium Efficiency grade and shall meet the NEMA MG 1-12.54" efficiency ratings

for energy efficient motors. All two speed motors, unless otherwise specified, shall be 1800/1200 rpm dual winding type. All 3 phase motors shall be designed and manufactured to be capable of speed control through a variable frequency drive controller. Motors shall be compatible with the furnished VFD controller.

Motors and other electrical control equipment installed in damp or moist areas or in areas of other special conditions shall be designed and approved for the installation. Motors and electrical equipment in explosive locations shall be approved for those locations. Motors located outside buildings shall be totally enclosed.

#### Electric Wiring:

Electric power wiring conduit, flexible conduit, outlets, relays, thermal switches, auto-off-on switches, magnetic starters, and disconnecting switches shall be provided and installed under Division 16 "Electrical Work" for all electrical equipment furnished or installed as work of this Division.

All equipment control wiring and all automatic temperature control wiring including all necessary contacts, relays, and interlocks, whether low or line voltage, except power wiring, shall be furnished and installed as work of this Division unless shown to be furnished by Division 16. Installation of any and all wiring done under Division 15 shall be in accordance with the requirements of Division 16, Electrical.

All equipment that requires an electrical connection shall be furnished so that it will operate properly and deliver full capacity on the electrical service available and also satisfy the requirements under "Motors," as specified above.

The Mechanical Contractor must refer to the electrical control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment.

The Mechanical Contractor must coordinate with the Electrical Contractor to insure that all required components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

#### WORK, MATERIALS, AND QUALITY OF EQUIPMENT:

Unless otherwise specified, all materials shall be new and of the best quality of their respective kinds and all labor shall be done in a most thorough and workmanlike manner.

Products or equipment of any of the manufacturers cited herein or any of the products approved by the Addenda may be used. However, where lists of products are cited herein, the one first listed in the design equipment used in drawings and schedules to establish size, quality, function, and capacity standards. If other than design equipment is used, it shall be carefully checked for access to equipment, electrical and control requirements, valving, and piping. Should changes or additions occur in piping, valving, electrical work, etc., or if the work of other Contractors would be revised by the alternate equipment, the cost of all changes shall be born as work of this Division.

Pipe of foreign manufacture will not be acceptable.

The access to equipment shown on the drawings are the minimum acceptable space requirements. No equipment that reduces or restricts accessibility to this or any other equipment will be considered.

2 All major items of equipment are specified in the equipment schedules on the drawings or in these  
specifications and shall be furnished complete with all accessories normally supplied with the catalog item  
4 listed and all other accessories necessary for a complete and satisfactory installation.

6 All mechanics shall be capable journeymen, skilled in the work assigned to them. No one unskilled in the  
work which he is given to do shall be employed, and all work shall be executed in a skillful and workmanlike  
8 manner. All men employed upon this work shall be competent, faithful, orderly, and satisfactory to the  
Owner.

10 All welders shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code,  
latest Edition.

#### 12 PROTECTION AGAINST WEATHER AND STORING OF MATERIALS:

14 All equipment and materials shall be properly stored and protected against moisture, dust, and wind.  
16 Coverings or other protection shall be used on all items that may be damaged or rusted or may have  
performance impaired by adverse weather or moisture conditions. Damage or defect developing before  
18 acceptance of the work shall be made good at the Contractor's expense.

20 All open duct and pipe openings shall be adequately covered at all times.

#### 22 INSTALLATION CHECK:

24 An experienced, competent, and authorized representative of the manufacturer or supplier of each item of  
equipment indicated in the equipment schedule shall visit the site of the work and inspect, check, adjust if  
26 necessary, and approve the equipment installation. In each case, the equipment supplier's representative  
shall be present when the equipment is placed in operation. The equipment supplier's representative shall  
28 revisit the job site as often as necessary until all trouble is corrected and the equipment installation and  
operation is satisfactory to the Engineer.

30 Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report  
32 certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3)  
is free from any undue stress imposed by connecting piping or anchor bolts; and, (4) has been operated  
34 under full load conditions and that it operated satisfactorily.

36 All costs for this work shall be included in the prices quoted by equipment suppliers.

#### 38 EQUIPMENT LUBRICATION:

40 The Contractor shall properly lubricate all pieces of equipment before turning the building over to the Owner.  
A linen tag shall be attached to each piece of equipment, showing the date of lubrication and the lubricant  
42 used. No equipment shall be started until it is properly lubricated. The contractor shall give 48 hours notice  
prior to the completion of the lubrication so that the owner and engineer may verify.

44 Necessary time shall be spent with the Owner's Representative to thoroughly familiarize him with all  
46 necessary lubrications and maintenance that will be required of him.

48 Detergent oil as used for automotive purposes shall not be used for this work.

#### 50 CUTTING AND PATCHING:



No cutting or drilling in structural members shall be done without written approval of the Architect. The work shall be carefully laid out in advance, and cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces necessary for the mechanical work shall be carefully done. Any damage to building, piping, or equipment shall be repaired by professional plasterers, masons, concrete workers, etc., and all such work shall be paid for as work of this Division.

When concrete, grading, etc., is disturbed, it shall be restored to original condition as described in the applicable Division of this Specification.

#### ACCESS DOORS:

Provide access doors in walls, ceilings and floors, for access to mechanical equipment such as valves, dampers, VAV boxes, fans, controls, etc. Refer to Division 8 for door specifications. All access doors shall be 24" x 24" unless otherwise indicated or required. Coordinate location of doors with the Architect prior to installation. If doors are not specified in Division 8, provide the following: Doors in ceilings and wall shall be equal to JR Smith No. 4760 bonderized and painted. Also approved manufacturers are Cesco. Doors in tile walls shall be equal to JR Smith No. 4730 chrome plated. Doors in floors shall be equal to JR Smith No. 4910. Access doors shall be fire rated where required.

#### CONCRETE BASES AND INSERTS:

##### Bases:

The concrete bases shall be provided and installed as work of Division 3, Concrete. This Division shall be responsible for the proper size and location of bases and shall furnish all required anchor bolts and sleeves with templates to be installed as work of Division 3, Concrete.

All floor-mounted mechanical equipment shall be set on 4-inch high concrete bases, unless otherwise noted or shown on drawings. Such bases shall extend 6 inches beyond equipment or mounting rails on all sides or as shown on the drawings and shall have a 1-inch beveled edge all around.

#### V-BELT DRIVES:

V-belt drives shall be of fabric and rubber construction of approved manufacture. Multiple belts shall be matches and all belts shall be adjusted to drive the apparatus properly and to prevent slippage and undue wear in starting. Drives shall be designed for 150 percent of the specified motor nameplate rating. Belt guards shall be provided for all exposed belts and drives.

#### FLASHING:

All pipes, ducts and roof drains which penetrate roofs or exterior walls shall be flashed and sealed watertight under this Division of the specifications. All plumbing vents shall be extended to not less than 12 inches above the roof. Roof flashings shall be furnished by this Contractor and installed by the Roofing Contractor. Flashings shall be of the type required by the Roofing Contractor. Flashings shall be of the size required by the Roofing Contractor and shall extend horizontally not less than 12 inches all around. The Mechanical Contractor shall furnish and install flashings for all services and shall flash and counterflash all ducts and through roofs and exterior walls.

#### SEALING:

Pipe, conduit or duct and sleeve penetrations through fire rated floors and walls shall be sealed with Dow Corning 3-6548 Silicone RTV Foam or an approved equal. Refer to the manufacturers application guide specifications to determine proper installation procedures.

Pipe, conduit or duct and sleeve penetrations through non-fire rated floors and walls shall be sealed with Pecora butyl rubber BC-158 or an approved equal. Spaces greater than 1/4" wide must first be backed with a compressible foam backer rod and then caulked.

After stubbing and/or caulking, all openings are to be thoroughly taped with heavy plastic or butyl duct tape to prevent sound passage.

The contractors are responsible for the core drilling and sealing of piping penetrations thru the foundation walls as necessary to accommodate their work. Modular sealing units, designed for field assembly to fill the annular space between the pipe and opening shall be provided to create a waterproof seal. Sealing units shall be constructed of EPDM and stainless steel materials. Pipes shall be sealed using Link Seal or other approved method.

#### CLEANING AND PAINTING:

##### Cleaning:

After all tests and adjustments have been made and all systems pronounced satisfactory for permanent operation, this Contractor shall clean all exposed piping, ductwork, insulated members, fixture, and equipment installed under this Section and leave them ready for painting. He shall refinish any damaged finish and leave everything in proper working order. The Contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by his workman or for which he is responsible. He shall remove all stickers on plumbing fixtures, do all required patching up and repair all work of others damaged by this division of the work, and leave the premises in a clean and orderly condition.

##### Painting:

Painting of exposed pipe, insulated pipe, ducts, or equipment inside of the building is work of Division 9, Painting. Painting of exposed pipe outside is work of this section. All pipe exposed to the outdoors shall be painted for rust protection. Pipe, equipment, and duct identification is work of Section 15150.

Mechanical Contractor: All equipment which is to be furnished in factory prefinished conditions by the mechanical Contractor shall be left without mark, scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial numbers, or other identifying marks.

##### Removal of Debris, Etc:

Upon completion of this division of the work, remove all surplus material and rubbish resulting from this work, and leave the premises in a clean and orderly condition.

#### CONTRACT COMPLETION:

##### Incomplete and Unacceptable Work:

If additional site visits or design work is required by the Engineer or Architect because of the use of incomplete or unacceptable work by the Contractor, then the Contractor shall reimburse the Engineer and Architect for all additional time and expenses involved.

Maintenance Instructions:

The Contractor shall furnish the Owner complete printed and illustrated operating and maintenance instructions covering all units of mechanical equipment, together with parts lists. This maintenance manual shall be furnished as work of Section 15150.

Instructions To Owner's Representatives:

In addition to any detailed instructions called for, the mechanical Contractor must provide, without expense to the Owner, competent instructors to train the Owner's representatives who will be in charge of the apparatus and equipment, in the care, adjustment, and operation of all parts on the heating, air conditioning, ventilating, plumbing, fire protection, and automatic temperature control equipment. Instruction dates shall be scheduled at time of final inspection. A written report specifying times, dates, and name of personnel instructed shall be forwarded to the Architect. A minimum of three 8-hour instruction periods shall be provided. The instruction periods will be broken down to shorter periods when requested by the Owner. The total instruction hours shall not reduced. The ATC Contractor shall provide additional hours of instructions as specified in the ATC specifications.

Guarantee:

By the acceptance of any contract award for the work herein described or shown on the drawings, the Contractor assumes the full responsibility imposed by the guarantee as set forth herein and in the General Conditions, and should protect himself through proper guarantees from equipment and special equipment Contractors and from subContractors as their interests may appear.

The guarantee so assumed by the Contractor and as work of this Section is as follows:

That the entire mechanical system, including plumbing, heating, and air-conditioning system shall be quiet in operation.

That the circulation of water shall be complete and even.

That all pipes, conduit, and connections shall be perfectly free from foreign matter and pockets and that all other obstructions to the free passage of air, water, liquid, sewage, and vent shall be removed.

That he shall make promptly and free of charge, upon notice from the Owner, any necessary repairs due to defective workmanship or materials that may occur during a period of (2) years from date of Substantial Completion.

That all specialties, mechanical, and patent devices incorporated in these systems shall be adjusted in a manner that each shall develop its maximum efficiency in the operation of the system; i.e., diffusers shall deliver the designed amount of air shown on drawings, thermostats shall operate to the specified limits, etc.

All equipment and the complete mechanical system shall be guaranteed for a period of (2) years from the date of the Architect's Certificate of Substantial Completion. Any equipment supplier not willing to comply with this guarantee period shall not submit a bid price for this project. The Contractor shall be responsible for a 100-percent guarantee for the system and all items of equipment for this period.

All filters used during construction shall be replaced just before equipment is turned over to the Owner, and all required equipment and parts shall be oiled. Any worn parts shall also be replaced.

#### TEST RUN:

The Mechanical Contractor shall operate the mechanical system for a minimum of 20 days to prove the operation of the system. After the owner takes occupancy, the Temperature Control Contractor shall provide a temperature (0 to 200 degrees F) and pressure (0 to 12 inches w.g.) recorder and record for a period of 10 days in areas so designated by the Design Engineer.

During the beginning and last day of the 10 day test run, the Temperature Control Contractor shall record the temperature settings of all room thermostats. These recordings will be provided to the owner in a report.

#### MECHANICAL EQUIPMENT SUPPORT:

Contractor is responsible for supporting the mechanical equipment (i.e. pipes, ducts, fans, etc.) Mechanical equipment shall not be supported from the roof deck. Mechanical equipment shall be supported from the top cord of the roof joists. Intermediate beams, unistruts, etc. shall be secured to the roof joists at locations approved by structural engineer. Contractor shall provide and install all materials necessary to adequately support the mechanical equipment. connection types (i.e. weldings, clips, etc.) shall be in accordance with structural engineer recommendations. Contractor shall be responsible for support sizing, locations, and types and shall coordinate with job site conditions. Contractor shall comply with structural drawings and specification.

All equipment shall be independently supported from the structure so that it is not depending on the ceiling for support.

#### Roof:

All roof mounted equipment shall be a minimum of 10'-0" from roof edges, walls, parapets, etc unless appropriate hand rails are provided. All exhaust, relief, vents and intake locations shall be carefully coordinated to prevent cross contamination of intakes. Exhaust and vents shall be a minimum of 25'-0" from intakes, further if possible.

#### FACTORY START UP:

All major pieces of equipment shall receive a factory startup by the respective manufacturer's representative. The owner and the engineer shall be notified 48 hours prior to the commencement of any factory start up so that the owner and/or their agent may be on site for verification of work. The contractor shall include the factory start up reports in the O & M manuals. A copy shall also be sent to the engineer.

The following list of equipment shall receive a factory start up:

Split System Air Conditioners  
VFD's

There shall be no smoking anywhere inside the building after any wall coverings, ceiling grid, flooring, etc has been installed.

#### Substantial Completion:

Before requesting substantial completion the Mechanical Contractor shall complete the following:

Certificates of compliance from all authorities having jurisdiction, i.e. Boiler inspector for gas fired equipment, compressors, etc.

O and M Manuals to be completed and turned into the architect.

Factory start up of equipment completed and reports included in the O and M Manuals.

Seismic representative final review and report confirming compliance included in the O and M Manuals.

Water sterilization completed and report included in the O and M Manuals.

**PATCH AND REPAIR:**

The patching, repair and painting of floors, walls, ceilings, landscaping and asphalt shall be the responsibility of the General Contractor. The Div 15 contractor shall make every effort to minimize the amount of repair work required. The Div 15 contractor shall review the repair work anticipated with representatives of the general contractor prior to any work beginning in order to establish the scope of repair work that is anticipated. Any repairs necessitated by excessive demolition or damage and/or any repairs necessary in areas unrelated to this project but caused by this contractor, may be back charged to the contractor.

**SAWCUTTING:**

Sawcutting necessary for the installation of new work under Div 15 shall be responsibility of this contractor. Trenching and backfill shall also be the responsibility of this contractor and shall be coordinated with the general contractor in preparation for patching any floor required to be sawcut.

**EXISTING CONDITIONS:**

The Contractor shall carefully examine all existing conditions that might affect the mechanical system and shall compare these conditions with all drawings and specifications for work included under this contract. He shall, at such time, ascertain and check all conditions that may affect his work. No allowance shall subsequently be made in his behalf for an extra expense incurred as a result of his failure or neglect to make such examination.

This Contractor shall include in his bid proposal all necessary allowances to repair or replace any item that will remain or will be removed, and any item that will be damaged, destroyed or otherwise affected by new construction.

The Contractor shall remove all abandoned piping (unless noted otherwise) required by new construction and cap or plug openings. Any capping that is exposed in occupied areas shall be tamper proof and of good quality workmanship and shall be painted a color that blends with surrounding colors. All openings of items removed shall be sealed to match adjacent surfaces.

The Contractor shall verify the exact location of all existing conditions, services, utilities, piping, etc., and make connections to existing systems as required or as shown on the drawings. The exact location of each item, together with size and elevation, shall be established before any new work is installed. Should elevation or size of existing items make connections to them impossible as shown on drawings, then notification of such shall immediately be given to the Engineer for a decision.

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END OF SECTION

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DIVISION 15 - MECHANICAL

SECTION 15150

BALANCING, MAINTENANCE MANUALS, AND IDENTIFICATION

GENERAL CONDITIONS:

All pertinent sections of Section 15100, Division 15, are a part of the work described in this section. Division 1 is a part of this and all other sections of these specifications.

SCOPE OF WORK:

This work shall include the final adjustment, balancing of existing air handling and heating hot water systems. There is not any work necessary on the existing cooling, exhaust air and plumbing systems. The work of this section shall include but not be limited to the following.

Balancing and adjustments of the heating, air-conditioning, and ventilating systems furnished and installed as work of Division 15.

Supervision of start-up and commissioning of all systems and equipment furnished and installed as work of Division 15.

Submission of Operating and Maintenance Manuals complete with balancing and system commissioning reports.

Coordination of work involving other contractors essential to the final balancing of the system and supervision of the adjustments.

48 hours notice shall be given to the owner and the engineer prior to the commencement of the testing and balancing work and 48 hours prior to the completion of work.

RELATED WORK:

Installation of all materials, equipment, and controls of Division 15 is work of Sections 15100, 15150, 15300, 15700, 15800, 15900. Rough adjustment of all systems shall be work of the section installing the work.

SUBMITTALS:

Submit product data in accordance with Division 1 and Section 15100. Submit the following:

- Name and qualifications of Balancing Contractor.
- Name of certifying affiliation or certifying Professional Engineer.
- Sample test and balancing data forms.
- Sample of O & M manual outline and description of binder.
- System commissioning procedures and check list.

2 IDENTIFICATION:

4 Equipment Identification:

6 Information on labels shall include the following:

- 8 a. Identification number and name. Generally, this number and name shall be the same as that shown on the drawings or in these specifications.
- 10 b. If the item is a fan or pump, the flow and head shall be indicated.
- 12 c. If the item is part of a unit, the label shall have, in addition to its item number, the number of the main item it is serving.

14 Equipment nameplates shall be black faced formica with white engraved lettering at least 3/16 inch high.

16 OPERATING AND MAINTENANCE MANUALS:

18 Work under this section shall be performed by the contractor performing the system testing and balancing or by a Registered Professional Mechanical Engineer that has had previous experience in the writing of these manuals. Preliminary review copy of O & M to be provided at midpoint of construction schedule. Final review copy to be provided at the 75% construction schedule point. The final four (4) copies of the manuals shall be furnished to the Architect for distribution to the owner prior to contractor receiving substantial completion.

26 The "Start-Up and Operation" section is one of the most important in the manual. Information in this section shall be complete and accurately written and shall be verified with the actual equipment on the job, such as switches, starters, relays, automatic controls, etc. A step-by-step start-up procedure shall be described.

30 The manuals shall include Air-balancing reports, water-balancing reports, system commissioning procedures, start-up tests and reports, equipment and system performance test reports, warranties, and certificates of training given to the owners representatives.

34 The operating and maintenance manuals shall be as follows:

36 Binders shall be red buckram with easy-view metal for size 8-1/2 x 11-inch sheets, with capacity expandable from 2 inches to 3-1/2 inches as required for the project. Construction shall be rivet-through with library corners. No. 12 backbone and lining shall be the same material as the cover. The front cover and backbone shall be foil-stamped in white as follows:

40 OPERATING AND MAINTENANCE  
42 MANUAL  
44 FOR THE  
(INSERT NAME HERE, NAME TO BE PROVIDED BY ARCHITECT)

46 (INSERT YEAR OF COMPLETION)

48 Ogden, UTAH

50 Scott P. Evans ARCHITECTS  
52 Architect

VAN BOERUM & FRANK  
Consulting Engineers



Binders shall be a manufactured by Hiller Bookbinding.

An index sheet typed on AICO Gold-Line indexes shall be provided in the front of the binder. The manual shall be organized as follows:

SECTION I: START-UP AND OPERATION

FORWARD

START-UP PROCEDURE AND OPERATION OF SYSTEM

MAINTENANCE AND LUBRICATION TABLE

AUTOMATIC TEMPERATURE CONTROL DESCRIPTION OF OPERATION, INTERLOCK AND CONTROL DIAGRAMS, AND CONTROL PANELS.

SECTION 2: OPERATION AND MAINTENANCE BULLETINS

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>VENDOR</u>	<u>TELEPHONE</u>
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A.	<u>AUTOMATIC TEMPERATURE CONTROL</u>		
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B.	<u>HEATING SPECIALTIES</u>		
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D.	<u>HEATING AND VENTILATING EQUIPMENT</u>		
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SECTION 3: MAINTENANCE AND LUBRICATION REFERENCE TABLE

SECTION 4: AIR AND WATER SYSTEM BALANCING REPORTS

SECTION 5: EQUIPMENT WARRANTIES AND TRAINING CERTIFICATES

SECTION 6: SYSTEM COMMISSIONING REPORTS

System commissioning report

Equipment start-up certificates

SYSTEM AIR AND WATER BALANCE:

These systems shall be balanced and adjusted by person or persons fully familiar with mechanical systems of the type specified in this Division and whose main business is the balancing and adjustment of mechanical systems.

Contractors approved to do this work are Bob's Test and Balancing Co, TBI, or Certified Test and Balance. The balancing contractor must either be certified by NEBB, AABC, or must have all data, procedures, reports, etc. certified by a licensed Professional Mechanical Engineer actively engaged in the heating and air-conditioning field, who shall supervise the work.

The testing and balancing subcontractor shall have the necessary experienced personnel and equipment to accomplish the work.

Prior to commencement of the testing and balancing, the mechanical system shall be properly commissioned and ready for operation. Representatives of the equipment manufacturers shall have previously visited the project to verify that their equipment is ready for operation.

Reports shall be well organized and shall indicate design and measured values, percent of design values, items not yet complete, issues preventing completion, items needing contractor attention, controls completion status, etc.

Five (5) copies of this report shall be furnished so that one can be included in each Operating and Maintenance Manual and one copy is to be furnished to the Mechanical Engineer.

Start up reports shall be submitted for review prior to any test and balancing work performed.

#### ADJUSTMENT OF AIR DISTRIBUTION SYSTEMS:

All the constant volume and variable volume air handling systems shall be rebalanced to the quantities shown on the drawings. The Sheet Metal Contractor shall assign the foreman or mechanic who installed the sheet-metal air-handling systems to assist in the air-balancing work.

Fresh air dampers shall be set to their minimum positions as called for in the Temperature Control Specification.

All filters shall be clean and all room doors shall be closed during the balancing procedure.

All supply and exhaust air fans shall be running.

Relief air system shall be checked for proper operation.

All dampers shall be open.

An initial volume reading of each supply fan shall be taken with a pitot tube and draft gauge.

The Contractor shall measure rpm and adjust the sheaves of all fans to handle design quantity of air. He shall check and record motor amperage. The drives shall be changed as required, at the Contractor's expense, to provide the specified air quantities.

Test and record motor full load amperes.

A pressure test shall be made to verify the proper air flow from clean areas toward less clean areas.

- Make a pitot tube traverse of main supply and exhaust ducts and adjust systems to obtain design CFM at fans to within 5% of design quantities.
- Test and record static pressures, suction and discharge.
- Test and record entering and leaving air temperatures at all fans and coils (D.B. heating and cooling, W.B. cooling), including reheat coils.
- Adjust all main supply, return and exhaust air ducts to proper design CFM.
- Adjust all zones to design CFM, supply, return and exhaust.

Adjust all registers, grilles and diffusers to deliver design cfm plus or minus 10 percent of design requirements.

All tests and readings shall include required FPM and CFM, initial FPM and CFM and final FPM and CFM after adjustments. All adjustments shall be made to minimize drafts.

The Temperature Control Contractor shall have a mechanic available to the personnel adjusting the air system for assistance in adjusting any defective control devices.

#### Adjustment of the Heating Hot Water System:

The entire heating hot water system (except the glycol coil loop and under floor heating portion) shall be rebalanced to the quantities shown on the drawings. The Mechanical Contractor shall have a mechanic available to the personnel adjusting the water system for assistance in adjusting any defective control devices.

The Temperature Control Contractor shall have a mechanic available to the personnel adjusting the water system for assistance in adjusting any defective control devices.

The adjustment of the water system shall generally be as follows:

The expansion tank shall be checked for proper air charge.

All automatic valves and balancing cocks shall be set to their fully open operating positions.

One pump at a time shall be started and the amperage reading checked. If the motor amperage is exceeded, the pump discharge balancing valve shall be closed as required to provide the proper amperage reading.

After the system has been purged of air and all pumps are operating, the motor amperage and the suction and discharge of all pumps shall be read and recorded.

Each pump shall be balanced for its design flow.

Venturi meters shall be read and balancing cocks on all units shall be set for design flow.

Manual flow control valves on all coil units shall be adjusted. The correct percentage of automatic valves must be set to the fully open positions and the system water temperature must be constant. The design flow shall be set with the circuit setter.

The motor amperage and suction and discharge pressure and T.D.H. from each pump shall be read and recorded. The pump balancing valve shall be adjusted as required to give design flow.

Check, adjust and record the following items at each of the following:

Loop field inlet and leaving water temperatures in the cooling season and in the heating season.

Pressure drop across the loop field.

All valves shall be permanently marked at their final balanced positions.

Copies of this report shall be included in the operating and maintenance manual.

2 The Mechanical Contractor shall clean all dirty strainers as required during the balancing procedure and shall  
3 be responsible for draining and refilling the system.

4 Final Adjustment:

6 This Contractor shall be responsible for the final balancing and adjustment of all mechanical systems with  
7 necessary adjustments being made to provide a satisfactory system. If adjustments are required to produce  
8 other than conditions shown on the drawings because of job conditions, then these adjustments shall be  
9 made without extra costs.

10 The pressure taps, access openings, etc., necessary to balance the system, shall be installed by other  
11 Mechanical Contractors where directed by this Contractor.

12 The Balancing Contractor shall immediately notify the Architect, in writing, if any item of equipment, diffusers,  
13 grilles, etc., fails to operate within 5 percent of its specified capacity at the completion of the balancing of the  
14 system.

15 The report submitted by this contractor shall be certified to be correct by a Mechanical Engineer licensed in  
16 the State of Utah, who has originally been approved by the Architect. The reports shall be submitted to the  
17 General Contractor and he shall submit them to the Architect for review before submitting them to the Owner.

18 DUCT SYSTEM TEST:

19 All supply ductwork, both new and existing, shall be leak tested according to the requirements of the  
20 SMACNA. All leaks shall be sealed.

21 SYSTEM COMMISSIONING:

22 The contractor shall be responsible for developing a procedure for commissioning all equipment and  
23 systems furnished and installed as part of work of Division 15. This procedure shall be submitted to the  
24 Engineer for review. The commissioning procedure shall include a critical path chart showing the work to  
25 be performed, at which stage of construction the commissioning procedure should be performed, and the  
26 contractor who will perform the procedure. The following are the minimum requirements for commissioning.

27 The test and balance contractor shall be responsible to demonstrate as required the water and air  
28 measurements for the mechanical equipment on the project. The test and balance contractor shall make a  
29 technician available while the owner's agent is reviewing the mechanical equipment after the system has  
30 been tested and balanced by the test and balance contractor prior to the completion of the project.

31 The 100% complete test and balance reports shall be fully reviewed by the certified personnel responsible  
32 for the project, the report shall be signed by the certified person and shall be submitted in a final, typed  
33 format (handwritten reports not acceptable) a minimum of 2 days prior to the commencement of the final  
34 independent commissioning.

35 O & M Items

36 O & M Manuals Prepared

37 Instruction of Operating Personnel

38 Refrigeration Equipment

Started and Tested for Proper and Safe Operation

All Safety and Operating Controls Set and Tested

No Refrigerant Leaks

System Charged

#### Duct System

Ductwork Clean

Access Door Tightly Closed, Gasketed with Proper Hardware

Fire/Smoke damper properly operating

Balancing Dampers in Place, Open and Locked with Accessible Operators

All Terminals in Place

Minimum Allowable Duct Leakage has been Tested and Verified

Minimum Friction and Dynamic Loss

Openings in Walls and Shafts for Air Transfer

Insulation Completed

Access doors installed

#### Automatic Control System

Control System in Operation

All Controls Installed

Controls Set and Calibrated

Control Sequence Verified (can be a part of Testing, Adjusting and Balancing)

Tight Closing

Smooth Operation

Full Stroking

#### Equipment Checkout

Verify that installed equipment is same as equipment approved in shop drawings or specifications.

#### Pumps

2	Motors Aligned and Secured
4	Couplings Secured
6	Flexible Connections Correct
8	Pressure Gauge Properly Piped
10	Minimum of Negative System Effect
12	END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15300  
PIPING SYSTEMS, SPECIALTIES AND VALVES

GENERAL CONDITIONS:

All pertinent sections of Section 15100, Division 15, are a part of the work described in this section. Division 1 is a part of this and all other sections of these specifications.

SCOPE OF WORK:

This work includes furnishing all labor and materials to complete all piping systems including piping specialties and valves for the HVAC and plumbing systems.

RELATED WORK:

Refer to Section 15100 and 15700 for piping system tests.

SUBMITTALS:

Submit product data in accordance with Division 1 and Section 15100. Submit the following:

- Pipe, couplings, and fittings
- Valves
- Hangers and insulated pipe supports
- Specialty Items

PIPE AND FITTINGS:

NO PIPE OF A FOREIGN MANUFACTURER WILL BE ACCEPTABLE.

All piping, fittings, flanges, etc. shall be free from defects and shall comply with the appropriate ASTM specifications.

Black and Galvanized Steel Pipe: ASTM A53 ERW Grade B, Standard Weight (Schedule 40) or Extra Strong (Schedule 80) as specified.

Copper Tubing: ASTM B88, Type L or K as specified.

Threaded Malleable Iron Fittings: ANSI B16.3, 150-pound for Standard Weight Piping, 300-pound for Extra Strong Piping, or of weight or Schedule of matching piping either black or galvanized to match piping.

Copper Fittings: Wrought Copper, ANSI specification B16.22.

Drains for drip pans shall be Type L hard copper tubing with wrought-copper fittings. A P-trap shall be provided at drain pans.

Heating piping shall be Standard Weight black steel pipe. Pipe 2-1/2 inch and larger shall either have welding or mechanically grooved fittings. Pipe 2-inch and smaller shall have malleable iron screwed fittings.

Heating supply and return piping shall be insulated with Owens-Corning ASJ-25 fiberglass pipe insulation with vapor seal jacket. Pipe sizes 2" and smaller shall be insulated with 1" thick insulation. Pipe sizes larger than 2" shall be insulated with 1-1/2" thick insulation. The insulation shall be applied over clean, dry pipe with all joints firmly butted together. Fittings shall be similarly insulated with a fiberglass blanket insulation covered with a premolded PVC cover.

Refrigerant Piping and line sets shall be labeled and identified with piping type and flow direction. Exposed refrigerant piping on the roof shall be insulated with an aluminum jacket. See 15.700 for refrigerant line kit requirements.

#### Unions:

Unions shall generally be used on all connections to automatic valves and equipment and wherever necessary to prevent undue difficulty in making repairs or replacements. In general, unions are not required for flanged valves or equipment with flanged connections.

Grinnell 463, 250-psi, malleable iron ground joint, brass to iron seat unions shall be used on all threaded piping 2 inches and smaller.

Grinnell 487, 150-psi cast-iron gasket type, flanges with gaskets, unions shall be used on all threaded piping 2-1/2 inches and larger.

Grinnell Gruzlok mechanical pipe couplings for 2-1/2" and larger steel pipe.

In general, unions shall be provided at the following locations for all connecting piping:

- a. On each pipe at heating or cooling coil.
- b. At connections to heating or cooling equipment.
- c. On all sides of automatic valves where valves do not have union connections.

#### Insulating Fittings:

Dielectric unions or couplings as manufactured by Walter Vallet Company or Victaulic shall be installed to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

#### VALVES AND COCKS:

Nameplate or markings on each valve shall show manufacturer or trademark, size, grade, and pressure-temperature service rating.

Unless otherwise specified, all valves in connection with piping shall be Hammond, Milwaukee, Keystone, Crane, Centerline, Walworth, NIBCO, Watts, or Grinnell. Ball valves shall be bronze with bronze ball, teflon seat, indicator dial, insulated handle, and adjustable packing. Gate or butterfly valves shall be used on all water piping 2-1/2 inches and larger. Ball or globe valves may be used on all water piping 2 inches and smaller. Exceptions, if any, are shown on the plans or noted in specific sections of the specifications. All valves 2 inches and smaller shall be all bronze construction. Companion flanges shall be provided for butterfly screwed connections. Companion flanges shall be provided for butterfly valves and nonslam check valves. Valves, except where noted in specific sections, shall be rated for a minimum of 125-psi steam working pressure at 353 degrees F.



Valves locations are either shown or noted on plans; generally, however, any valve inadvertently omitted, or customarily furnished, or necessary for the proper maintenance and operation of this system shall be furnished as work of this Division.

Valves shall be installed with stems horizontal or above. Where possible, valves shall be located for operation from floors or platforms. Chain wheels or valve extensions shall be provided where valves are more than 11 feet above floors or platforms. Glands shall be tightened and gland packing added as required.

Nonslam check valves shall be used in the discharge lines from all pumps, except in-line pumps.

The following valves are used for design and descriptive purposes and to establish a standard of quality:

Gate valves 2 inches and smaller shall be Milwaukee 1151 or 1169; Grinnell 3080 or 3080SJ; NIBCO #T-134 or S-134.

Gate valves 2-1/2 inches and larger shall be Milwaukee F-2885-M; Grinnell 6020A; Crane 465-1/2; NIBCO #F-617-O.

Globe valves 2 inches and smaller shall be Milwaukee 590-T or 1590-T; Crane No. 7 or No. 1310; NIBCO #S-235-Y or T-235-Y; Grinnell 3240 or 3240SJ.

Globe valves 2-1/2 and larger shall be Milwaukee F-2981-M; Crane 350 or 351; NIBCO #T-718-B or F-718-B; Grinnell 6200A.

Calibrated balancing valves shall be Bell & Gossett Circuit Setter, equipped with Barco shutoff valves and quick-disconnects or Armstrong CBV. ( These shall not be used at heat pumps, see flow control valve specification for heat pumps.)

Check valves 2 inches and smaller shall be Milwaukee 509 or 1509; Crane No. 36 or No. 1342; NIBCO #T413-B or S-413-B; Grinnell 3300 or 3300SJ, Mueller, Stockham or Watts.

Check valves 2-1/2 inches and larger shall be Milwaukee F-2974-M; Crane No. 373 or 374; NIBCO #F-918-B; Grinnell 6300A. Nonslam check valves shall be Mission Duo-Check 60SVF or Watts F-ICU-125 or Central Sprink.

Butterfly valve 2" and smaller shall be Milwaukee Butterball BB2-100 or BB2-350.

Butterfly valves 2-1/2" and larger shall be lug type Milwaukee ML-223-E for 5" and below or Milwaukee ML-323-E for 6" and above rated bubble-tight dead end service at full 200 psi working pressure or Central Sprink.

Ball valves shall be Milwaukee BA-100 full ported two-piece construction, or Milwaukee BA-300 full ported three piece construction or Watts B-6000.

Balancing cocks 2 inches and smaller shall be Crane No. 250 or Milwaukee Butterball BB2-100 or BB2-350 with memory stop.

Air vent valves shall be Crane No. 88 or Milwaukee 600, 200-psi working pressure, 3/8 inch bronze needle-point globe.

Valve assemblies by Griswold, Flow Design, Hays, Flow Set or HCI may be used.

#### SPECIALTIES:

### Pressure Gauges:

The Contractor shall furnish and install liquid filled U.S. Gauge, Trerice, Marsh, Weksler, Weiss, Marshalltown, or Ashcroft, 3-1/2 inch minimal dial or as noted on the drawings, black cast-aluminum pressure gauges and chrome-plated ring. All gauges shall be provided with a shutoff cock and snubber. Each gauge shall be of the free-standing repairable type, with graduations and scale suitable for the pressure encountered. Compound gauges shall be installed where necessary. A list of all gauges with graduations, type, and locations shall be submitted to the Engineer for approval before any gauge is installed.

### Strainers:

Strainers shall be Keckley, Sarco, Victaulic, Mueller, Central Sprink or Webster, of the self-cleaning type. Perforations in strainers shall be 1/16 inch in diameter. Blowoff ball valves with shall be provided for all strainers. A threaded hose connection shall be provided on all strainers located above ceilings. The outlet of all other strainer blowoff shall be piped to above floor in a location adjacent to a wall or so that traffic or accessibility to equipment is not restricted and so that any item or piece of equipment is not damaged. Pressure rating of strainers shall be equal to but in no case less than the pressure testing of adjoining valves.

### Thermometers and Test Wells:

Where indicated on the drawings and the water piping diagrams, thermometers as manufactured by the Moeller Instruments Co., Weksler, Palmer, Weiss, or approved equal shall be installed. Thermometers shall be provided with glass red reading column, mercury filled, 9-inch scale, V-shaped, straight, angular, or inclined pattern as required by conditions under which they are to be installed and as required for proper reading. Thermometers shall be provided with expansion heads as required by their location in the piping system. Thermometers shall be provided with expansion heads as required so that they will not break under extremes of temperature. Each thermometer shall be provided with a separable socket well which shall be placed in the piping system. The well and stems of thermometers shall be the length required for accurate reading of the thermometer. Where thermometers occur in the insulated piping systems or on installed equipment, extension necks shall be provided so that the thermometer casing is outside of the insulation. Thermometer test wells equal to Moeller bar stock test well with plug and chain will be installed in outlet water connection to each cooling coil, and from the outlets of all heating coils in the main air-handling unit equipment rooms, so that the water flow may be properly balanced. Thermometers shall be calibrated at mid-range of scale before they are installed.

### Combination Pressure Temperature Test Wells:

Where indicated on the drawings, combination test plugs by Universal Control or Flow Design shall be installed. Two sets of pressure gauges and thermometers for use by the building maintenance staff shall be provided.

### PIPE HANGERS AND SUPPORTS:

All necessary structural members, hangers, and supports of approved design shall be provided to keep piping in proper alignment and to prevent transmission of injurious thrusts and vibrations. Pipe hangers shall generally be of the clevis pipe-clamp type with suspension bolts. All bolts shall have provision for vertical adjustment and shall be equipped with locknuts. Where concrete inserts are used, they shall be suitably reinforced. The Contractor shall obtain approval of the Architect for the location of such inserts prior to their installation. Pipe supports in tunnels shall be roller type with protective saddles. Spring and spring roller hangers shall be used wherever vertical movement of pipe occurs so that pipe and pipe supports shall always be in absolute contact. Expansion shields may be used provided that the hanger is not attached rigidly to the expansion bolt, but is supported from a suitable bracket held in place by expansion bolts. No

hanger shall be welded directly to steel joists. Where joists occur, clips shall be installed and hanger rod attached to clips. All piping hung from joists shall be hung from joist panel points. Protective saddles shall be provided on all insulated piping at point of hanger. Hangers shall not contact pipe where pipe is specified to be insulated and hangers shall not penetrate insulation.

The following is a schedule of maximum spacing for hangers or other supports and sizes of suspension rods for piping. In addition to the spacing listed, an additional hanger shall be provided 1 foot 0 inches from each pipe drop, rise, or turn.

Maximum Spacing		
<u>Pipe Size</u>	<u>Rod Diameter</u>	<u>Steel Pipe / HDPE Pipe</u>
1-1/4 in. and smaller	1/2 in.	6 ft./ 2 ft.
1-1/2 in. and 2 in.	1/2 in.	9 ft./ 2 ft.
2-1/2 in. and 3 in.	5/8 in.	10 ft./ 4 ft.
4 in. and 6 in.	3/4 in.	10 ft./ 4 ft.
8 in. and 10 in.	7/8 in.	10 ft./ 4 ft.
12 in. and 14 in.	1 in.	10 ft./ 4 ft.

Pipes larger than 3 inches in diameter must be hung from beams. Where beam spacing is greater than a 10 foot 0 inch span for pipes, intermediate beams must be installed to support pipes. Groups of pipes anchored to floor slabs shall not exceed a 300-pound load between beams. Intermediate beams shall be provided to support pipes if a 300-pound load is exceeded.

Pipes larger than 3 inches which must be supported from roof joists shall be hung from every joist (max. 7'-0" o.c.). the hangers shall be within 3 inches of panel points or the mechanical Contractor shall add a brace to the joist as per the structural general notes or as directed by the architect.

Pipe hangers shall not be welded to metal pan floor. Pipe hangers shall be concrete inserts installed in holes drilled in concrete.

All hangers, supports, and anchors shall be assembled with heavy pattern, hexagon carbon steel nuts.

Perforated metal strap shall not be permitted.

Pipes above ceilings are to be grouped together and either hung from individual rod hangers or on Unistrut trapeze hangers as shown on the drawings. Pipes are to be run as high as possible for maximum clearance of attic spaces.

Risers shall be properly supported and guided at each floor. Pipe hangers, inserts, rollers, etc., and all necessary accessories required to support piping shall be provided by the Contractor, unless noted otherwise.

The Contractor shall install all the metal supports in the equipment rooms to form a pipe rack. All other piping installed on racks is to be provided with metal saddles and U-bolt guide supports and supported from the metal frame of the rack.

All soil, waste, and vent stacks shall be substantially supported at the base with either a base stack fitting and concrete block or a riser clamp resting on the floor slab.

All pipe hangers, inserts, trapezes, etc., and all necessary accessories required to support the piping shall be provided by this Contractor.

All pipe hangers shall be installed outside of insulation on all insulated lines.

Manufacturers may be Blaw-Knox, Grinnell, or Pipe Shields, Inc.

#### Insulated Pipe Supports:

Insulated pipe supports shall be furnished and installed by the Mechanical Contractor on all insulated pipe and tubing according to the following tables. See Pipe Insulation Specification Section. Supports shall be Pipe Shields, Inc. All designations as to hanger type refer to Pipe Shields, Inc., model numbers.

#### Horizontal Pipes:

##### Model Designations

Pipe Size	Maximum Horizontal Spacing	In Ring Or Clevis Hanger		On Flat Surface		On Pipe Roll	
		Cold	Hot	Cold	Hot	Cold	Hot
Through 1-1/4"	7'-0	CS-CW	CS	CS-CW	CS	CSX-CW	CSX
1-1/2 9'-0	CS-CW	CS	CS-CW	CS	CSX-CW	CSX	
2 - 4 10'-0	CS-CW	CS	CS-CW	CS	CSX-CW	CSX	
6	10'-0	CS-CW	CS	CS-CW	CS	CSXP-CW	CSXP
8	10'-0	CS-CW	CS	CSXP-CW	CSXP	MXP	MXP
10-16 10'-0	CS-CW	CS	MXP	MXP	MXP	MXP	
18	10'-0	NCP	NCP	MXP	MXP	MXP	MXP
20	10'-0	NCP	NCP	MXP(c)	MXP(c)	MXP(b)	MXP(b)
24	9'-0	NCP	NCP	MXP(a)	MXP(a)	MXP(a)	MXP(a)

#### Notes:

- a) 7'-0 maximum spacing
- b) 8'-0 maximum spacing
- c) 9'-0 maximum spacing

#### Vertical Pipes: (All Pipe Sizes)

<u>Pipe Riser Clamp Model</u>	<u>Maximum Vertical Centers</u>
PRV	15'-0
HPRC	40'-0

Insulation shall be asbestos-free calcium silicate; 100 psi avg. compressive strength with a K = 0.38 BTU in/ft<sup>2</sup>/DegF/Hr. Insulating structural insert shall be asbestos-free calcium silicate; 600 psi avg. compressive strength treated with water repellent.

Jackets shall be galvanized sheet steel ASTM A-527; straps and load distribution plates to be carbon steel ASTM A-36; fasteners to be ASTM A-307, cadmium plated.

#### PIPE INSTALLATION:

All piping systems shall be installed so that they can be easily drained by means of drainage of low points of all piping without disconnecting pipe. If not specifically indicated on the drawings, the frequency of draining shall determine whether drain caps, plugs, cocks, or valves are to be used. If other than valves are contemplated, the Architect's permission must be obtained.

All installed pipe lines shall be straight, free from dents, scars, and burrs, with ends reamed smooth, and shall remain straight against strains tending to cause distortion during system operation. The Contractor shall make proper allowance for pipe line expansion and contraction so that no unsightly distortion, noise, damage, or improper operation results therefrom.

Piping shall run only parallel or at right angles to the walls or axes of the building and shall be neatly organized. The Contractor shall study the architectural, structural, mechanical, electrical, and other drawings to eliminate conflict of piping with other structure lighting or other services. Unless specified otherwise, no piping shall be exposed in a finished room, except in shop or storage areas. All changes in direction shall be made with fittings.

No piping shall be run above any electrical panels, electrical equipment or access clearances for electrical for electrical panels or equipment. No piping shall be allowed to run through any electrical rooms.

All piping shall be clean and free from acids and loose dirt when installed and shall be kept clean during the completion of the installation.

Plugs of rags, wools, cottons, waste, or similar materials may not be used in plugging. All piping shall be so arranged to not interfere with removal of other equipment or devices; and to not block access to manholes, access openings, etc. Piping shall be arranged to facilitate equipment maintenance. Flanges or unions, as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment. Piping shall be placed and installed so that there will be no interference with the installation of the air-conditioning equipment, ducts, etc. All piping shall be so installed to insure noiseless circulation. All valves and specialties shall be so placed to permit easy operation and access, and all valves shall be regulated and packed, and the glands shall be adjusted at the completion of the work and before final acceptance. All piping shall be erected to insure proper draining. Cooling and heating piping mains may be run level, with traps avoided where possible. Drain valves shall be provided at all low points and manual air vents at all high points in heating and cooling piping. No bushings, short nipples, or street-type fittings shall be used.

Drain valves shall be installed at all low points in all piping systems to allow for complete drainage of piping systems.

When insulated pipes are supported by a roller hanger they shall be protected from damage by suitable pipe covering protection saddles. Saddles shall support pipe on roller and shall be packed with insulation.

Grade:

Heating supply and return mains shall be graded upward in the direction of flow (arrows on drawings) 1/4 inch per 10 feet. High points in system shall be vented and drains at low points shall be piped to the nearest floor drain. Provide valving for complete drainage of piping systems.

In general, all fittings shall be standard welding type. Weld-O-Lets may be used on low-pressure lines 2 inches and smaller. Under no circumstances shall pipe be notched, mitered, or swaged.

#### Screwed Connections:

Piping 2" and smaller shall be screwed. All changes in direction shall be made with standard threaded fittings. Under no conditions will piping be notched, mitered or swaged.

All piping shall be accurately sized to measurements established at the building and worked into place without springing or forcing. Proper provisions shall be made for the expansion and contraction of all pipe lines. Screw joints shall be made with a lubricant applied to the male threads only. Threads shall be full cut and not more than three threads on the pipe shall remain exposed.

All pipe connections to roof drains shall be made with a relatively short riser and a horizontal swing joint so that, as the camber leaves the roof structure, the roof drain will not be forced upward.

#### Joints in Copper Piping:

Pipe shall be cut square and true. The end shall be deburred, reamed, and/or sized as necessary. The pipe shall be cleaned with medium grit emery cloth and, if the fitting socket is tarnished or shows oxidation, it shall be likewise cleaned. The pipe shall be inserted in the fittings and heat shall be applied to the fittings. Joints in copper piping for all above grade domestic water piping shall be soldered joints. Use ASTM B813, water flushable, lead free flux; ASTM B32, lead free alloy solder and ASTM B828 procedure, unless otherwise indicated.

An approved isolation fitting shall be installed at the junction of all steel and copper pipes. This shall not apply to copper black steel connections at radiation convectors, cabinet heaters, and coils.

T-drill is not acceptable.

#### EQUIPMENT CONNECTIONS:

All piping connecting to equipment shall be installed without strain. The Contractor shall be required as directed to disconnect piping to demonstrate that it has been so connected.

#### EXPANSION AND CONTRACTION:

The Contractor shall make all necessary provisions for expansion and contraction of piping with Victaulic or Central Sprink couplings, expansion joints, offsets, or expansion loops as required or shown, to prevent undue strain.

#### CROSS CONNECTIONS:

No plumbing fixture, device, or piping shall be installed that will provide a cross connection interconnection between a distributing water supply for drinking or domestic purposes and a polluted supply, such as a drainage system or a soil or waste pipe, which will permit or make possible the backflow of sewage polluted water, or waste into the water supply system.

ROOF DECK:

Steel roof deck shall not be used to support loads from plumbing, HVAC ducts, light fixtures, architectural elements or equipment of any kind. These elements are to be hung from the steel framing members as shown in the contract document.

Composite roof deck with concrete can support loads. Mechanical equipment and large pipes shall not be supported by the composite roof deck. Use additional framing members to support these elements as shown in the contract documents. The supplier is responsible for providing supporting anchors which are embedded in the concrete and which have adequate capacity to support the loads. If the deck is slotted in order to insert anchors, the deck shall be cut parallel to the deck flutes. In no case should the deck ever be cut perpendicular to the deck flutes.

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15700

HEAT TRANSFER SYSTEMS

GENERAL CONDITIONS:

All pertinent sections of Section 15100, Division 15, are a part of the work described in this section. Division 1 is a part of this and all other sections of these specifications.

SCOPE OF WORK:

Work under this section shall include all labor, materials, and equipment to complete the work for the entire project and shall include but not be limited to the following:

New pump, piping and radiation additions to the existing building.

Structural supports for all mechanical equipment.

Substantially complete and accurate adjustment of all equipment of this Section. Equipment shall be ready for final adjustment as work of Section 15150.

RELATED WORK:

Pipe is specified in Section 15300.

SUBMITTALS:

Submit product data in accordance with Division 1 and Section 15100. Submit the following:

Air Vents, Balancing Fittings, and Relief Valves  
Flexible Connectors, Expansion Tanks, Pumps,  
Coils, Water Treatment Systems, Heat Pumps, Air Handlers, etc.

TESTS:

New piping shall be tested with a 200 pound hydrostatic test. Valves shall be installed as necessary to isolate system. The pressure shall remain on all parts of the system for sufficient time to permit a complete examination and inspection.

Defective Work: If inspection or tests show defects, such defective work or material shall be replaced or corrected and inspection and tests shall be repeated. All repairs to piping shall be made with new materials. No caulking or screwed joints or holes will be acceptable.

All defects in material and workmanship which appear during the test shall be promptly remedied and the test shall be reapplied.

Enclosed Piping: Any piping which is to be insulated, placed within the construction, or otherwise concealed shall be carefully tested before being permanently enclosed.



Test Instruments: All testing shall be performed in the presence of the Architect and his Mechanical Engineer or as otherwise directed and shall meet with their approval. Instruments required for making the tests shall be provided by this Contractor. Relief valves set to avoid excessive pressure during testing shall be provided.

Required Adjustments: Before final acceptance of the piping system as a whole, this Contractor shall make all required adjustments, including controls, flush valves, etc., and shall place the entire piping system in a perfect operating condition. At the completion of the work, this Contractor shall furnish the Architect with all certificates of inspection.

#### GENERAL REQUIREMENTS:

##### Air Vents:

Air vents shall be installed on all high points. Each air vent shall consist of a 1-inch pipe chamber 6 inches long. Manual air vents shall be used at all locations.

Manual air vents shall be Jenkins (Fig. 743-G or Fig. 744-G), needle valves, 1/8-inch size, Walworth, Powell, or equal.

##### Test Tees and Pressure Taps:

This Contractor shall install all necessary test tees and pressure taps to properly balance the system. He shall provide pressure and temperature test tees equal to "Pete's Plugs" where directed by the Balancing Contractor, at each heat pump supply and return connection and elsewhere as needed.

##### Balancing and Adjustment:

This Contractor shall initially balance and adjust the systems. Final balancing shall be the work of Section 15150. The Mechanical Contractor shall furnish a mechanic to the Balancing Contractor to assist in the balancing work.

With all strainers clean, all heat pump units handling the proper quantity of air, and all temperature control valves open, the balancing fittings on the heat pump shall be adjusted as necessary to provide a balance distribution of water quantities.

#### EQUIPMENT:

Installation Check: See Section 15100, par. "Installation Check"

##### Pump Suction Diffusers:

Pump suction diffusers to match the system pipe size and pump inlet size shall be furnished and installed where shown on the drawings. Units shall consist of angle type body with inlet vanes and combination diffuser-strainer-orifice cylinder. Suction diffuser shall be furnished by pump manufacturer.

##### Base-Mounted Pumps:

Packless flexible coupled or split case pumps with heavy cast-iron base plate shall be furnished and installed as shown. Pumps shall be securely bolted to vibration inertia base as specified. The weight of the piping shall not be supported on the pumps. Pumps shall be 1750 rpm with bronze impeller, wearing rings, stainless steel shaft, and ceramic seal. Pumps shall be suitable for hot water and shall be suitable for 250 degrees F operating temperature and 125 psi working pressure.

Impeller shall be shaved to provide exact operating point specified on drawings. Motor size shall be as shown on the drawing, but, if an alternate pump is supplied that could operate in the overload range, a larger motor shall be furnished. Motor shall not operate overloaded.

Rubber flexible pipe connectors shall be installed on the supply and return pipes at base-mounted pumps. They shall be so located that no pipe hangers or supports shall be installed between them and the piece of equipment served.

Pumps shall be Bell & Gossett, Taco, Weiman or Armstrong.

#### Finned Tube Radiation:

Furnish and install fin-tube heating element and enclosures as indicated on plans. Installation shall be supplied with all components and accessories for a complete installation as detailed, all as manufactured by Vulcan Radiator Company.

Heating element shall have the capacity as shown on the plans and shall consist of full hard aluminum plate fins not less than .020" thick and actually embedded in copper seamless drawn tube with 40 fins per foot, guaranteed for working pressure of at least 150 psi at 200 Deg. F.

The enclosures for wall mounted radiation shall be DuraVane DVF with dimensions indicated on the plans and shall be fabricated from 16 ga. electro zinc-coated, rust resistant bonderized steel finished with a baked enamel finish in color selected by Architect. Louvers on enclosure shall have pencil-proof air discharge slots. Vertical stiffeners with 1/2" deep flanges shall be provided at enclosure joints. Enclosures and 90 degree corners shall have flush joints with no exposed fasteners. End closures and end trim shall have roll-flanged edges, allowing enclosures to telescope within, and shall have no visible fasteners. Access sections shall be provided at shut-off valves, balancing valves, and air vents. Full height Dura-mount solid back shall be provided.

Support brackets shall be die-formed with saddles that shall positively position heating element and pipe away from brackets and enclosure joints and allow 1-5/8" or more lateral movement for expansion and 1-1/2" height adjustment for pitch. Nylon coated support arm shall allow free sliding of saddles.

Include details of radiation supports in shop drawing. No order for radiation shall be placed by the Contractor until approved shop drawings are received by the Contractor.

#### Ductless Split-Type Air Conditioner:

Provide a ceiling suspended ductless split-type air conditioner with indoor evaporator section and outdoor condensing unit. Indoor unit shall have adjustable outlet, quiet operation, microprocessor remote control panel. Outdoor unit shall have corrosion-resistant cabinet containing compressor, copper-tube aluminum-fin coils, direct-drive centrifugal fans with motors with internal overload protection; capacity control to minus 20 deg F. Provide refrigerant line kit and roof supports. Unit shall be Fujitsu, Mitsubishi or Sanyo.

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15800

AIR DISTRIBUTION, HEATING AND AIR CONDITIONING

GENERAL CONDITIONS:

All pertinent sections of Section 15100, Division 15, are a part of the work described in this section. Division 1 is a part of this and all other sections of these specifications.

SCOPE OF WORK:

The scope of work shall include all labor, material, and equipment necessary to complete the air distribution, heating and air conditioning work for the entire project, including but not limited to the following:

All ductwork, plenums, sheet metal partitions, and specialties required for the air distribution and ventilating system.

Registers, grilles, and diffusers.

Acoustical lining in ductwork.

Connection to equipment furnished by other Contractors and prepurchased by Owner.

Installation of all floor and wall blockouts for floor or wall outlets.

Substantially complete and accurate adjustment of all equipment of this section, ready for final adjustment as work of Section 15150.

Sheet Metal Contractor to furnish a man to assist the Balancing Contractor in the balancing to operate equipment and to change belts and sheaves.

All automatic dampers are furnished by the Temperature Control Contractor. They shall be installed by the Sheet Metal Contractor under the supervision of the Control Contractor.

RELATED WORK:

Testing, balancing, and leak testing of ductwork is included in Section 15150. Electrical work, in general, is included in Division 16.

SUBMITTALS:

Submit product data in accordance with Division 1 and Section 15100. Submit the following:

Registers, Grilles and Diffusers  
Duct liner, sealer

MATERIALS:

Unless otherwise specified, galvanized iron shall be used throughout, fabricated and installed so that no vibration or noise results. It shall be made from the best grade of galvanized mild steel sheets of the U.S. Standard gauge and shall be free from blisters, slivers, and pits.

2 All seams shall be hammered and made airtight. The construction of all ductwork, including gauges of metal,  
bracing layout, etc., shall be in accordance with the following manuals of the Sheet Metal and Air  
Conditioning Contractors National Association, Inc. (SMACNA).

4 Ductwork and plenums shall be in accordance with SMACNA, "HVAC Duct Construction Standards, Metal  
6 and Flexible", latest edition.

8 SHEET METAL GENERAL REQUIREMENTS:

10 All duct systems shall be constructed to the pressure requirement indicated for the fan serving that duct  
system. Ductwork systems with a fan pressure requirement less than 2 inches w.g. shall be constructed to  
12 meet the requirements of the 2 inch w.g. pressure class. Ductwork on the suction side of the fan shall be  
constructed to the negative pressure class requirements. Ductwork on the discharge side of the fan shall  
14 be constructed to the positive pressure class requirements.

16 The Contractor shall exercise utmost care to obtain a smooth surface inside of all ductwork, absolutely free  
from small fins, imperfect joints, or other obstructions that cause noise and increased friction. Any additional  
18 duct offsets or turns not shown on plans or increases in length of run necessary to overcome obstacles shall  
be called to the attention of the Architect so that an acceptable rearrangement can be worked out. Under  
20 no circumstances shall the cross section of any duct be decreased by dents, pipes, or hanger rods running  
through it unless otherwise indicated on the drawings. Neither shall the shape be changed without approval.  
22 No quick transitions that restrict the area shall be used. Where necessary to gain clearance, the duct seams  
may be turned inside. Structural and Architectural drawings shall be consulted for areas with restrictive  
24 clearances. This work shall be installed in cooperation with other trades so that there will be no delay in  
progress of construction work.

26 During the installation, the open ends of all ducts shall be protected by covering them with plastic sheet tied  
28 in place to prevent debris and dirt from entering. It is extremely important that the duct system be clean  
before finish painting is done.

30 Duct Joints:

32 All duct joints, seams and fittings must be sealed airtight as required by the SMACNA Manual table 1-2, seal  
classification A. All return air ductwork joints shall be sealed as required by SMACNA Manual table 1-2, seal  
34 classification C. The term "seal" or "sealed" means use of mastic or mastic plus tape or gasketing as  
appropriate.

36 The system must be installed according to the manufacturer's instruction and assembly booklet.

40 Round Ductwork - Low Pressure:

42 The round ductwork and accessories shall be factory fabricated, spiral conduit as manufactured by United  
Sheet Metal Company, Metco, Sheet Metal Products Co., Everdur, Ventline or Dees Spiral Pipe and Fittings.  
44 The conduit shall be constructed of rust-resistant zinc-coated steel of the sizes called for on the drawings.

46 All fittings in the round pipe shall be factory fabricated to match the spiral conduit and shall be of the same  
manufacturer. All elbows and fittings shall be fabricated from galvanized sheets at least one gauge heavier  
48 than connecting conduits. Ninety-degree elbows shall be equal to United Sheet Metal Company type E-5,  
five-piece construction with a centerline radius of 1-1/2 times the pipe diameter. All elbows and fittings shall  
50 be constructed in accordance with SMACNA recommendations.

52 Shop or job fabricating pipe and fittings will not be acceptable.

Pipe-to-pipe joints are by slip-fit or by projecting collar of the fitting into the pipe.

Insertion length of sleeve coupling and fitting collar is 2 inches for diameters through 9 inches and 4 inches for diameters 10 inches through 60 inches.

Approved sealer equal to "Hard Cast" shall be applied to all duct joints. After the joint is assembled. Sealer is then applied to the outside of the joint, extending 1 inch on each side of the joint bead and covering the screw heads. Plastic backed tape is immediately applied over the wet sealer.

The duct sealer must be specifically formulated for the job of sealing the field joints for high-pressure systems. The sealer shall be compatible with plastic-backed duct tape so the two shall cure and bond together. Samples of sealer and tape and the specification data sheets shall be submitted to the Engineer for approval.

Flanged joints shall be sealed by Neoprene Rubber Gaskets.

#### Elbows:

Radius type elbows shall be used wherever possible. Radius elbows shall have a center line radius of at least 1.5 times the duct width. Short radius elbows will not be allowed. Square elbows may be used if they are provided with turning vanes.

#### Branch Take-offs:

Expanded throat high efficiency takeoffs shall be used for all branch takeoffs unless shown otherwise on the drawings. An opposed blade volume damper with locking quadrant shall be provided at each branch takeoff. Where dampers are not accessible for adjustment from above, concealed ceiling regulators with adjustable chrome-plated covers shall be provided. High efficiency take-offs shall be Hercules or Daniel.

#### Dimensions:

Ducts, unless otherwise approved, shall conform accurately to the dimensions indicated on the drawings, and shall be straight and smooth on the inside with joints neatly finished. All duct sizes are net free inside dimensions. Acoustically lined ducts shall have outside dimensions increased as required to accommodate the acoustic lining specified and still maintain the free area inside dimensions shown on the drawings.

#### Field Verification:

No ductwork shall be fabricated without first field verifying that the available space under the actual job conditions will permit installation of the ductwork without structural or other conflicts. This Contractor shall provide all necessary offsets and transitions to make all parts fit without additional compensation.

#### Duct Cleaning:

Before ducts are insulated and before the ceiling is installed and final connections made to the terminal boxes, the fans shall be operated at full capacity to blow out any dirt and debris from the ducts. The full capacity of the fan shall discharge into the duct. If it is not practical to use the main supply blower for this cleaning, the ducts may be blown out in sections by a portable fan. After the ducts have been cleaned and initially pressure tested, the final connection shall be made to the terminal boxes.

#### SHEET METAL SPECIALTIES:

### Flexible Connections:

This Contractor shall provide flexible connections not less than 4 inches wide, constructed of heavy, waterproof, woven plastic-coated glass fabric at each ducted heat pump unit, securely fastened to the unit and to the ductwork by a galvanized iron band, and provided with tightening screws. Corners shall be sewn tight shut. The connection shall be 20-ounce Ventfab.

### Volume Dampers:

Opposed-blade balancing dampers (OBD) to 12 inches by 36 inches: Dampers used in low-velocity branch ducts to control the volume or air flow shall be Young No. 817 volume control dampers. An operating head shall be placed on the side of the duct and shall be locked in position by a set key where the damper is accessible. Where the damper is not accessible, Young No. 817A or 817B volume control damper, consisting of an end bearing or miter gear, coupling, 3/8-inch square shaft, and a 31 x 3/8 inch regulator for operating the unit from suspended ceiling shall be provided.

Opposed-blade balancing dampers (OBD) larger than 12 inches by 36 inches: (Air Balance type AC2) opposed-blade damper of 14-gauge galvanized steel with locking quadrant shall be used or Ruskin, Louvers and Dampers, Daniel, United Air, or Safe Air.

### Damper Regulators:

All volume dampers and splitter dampers in exposed ductwork shall be provided with Ventlock No. 640 or Young No. 443 damper regulators. Each volume damper and splitter damper concealed above an inaccessible ceiling, etc., shall be provided with a shaft extended through the ceiling, to which shall be attached a chrome-plated Ventlock No. 666 concealed damper regulator. No. 680 Ventlock miter gears shall be used where necessary.

### ATC Dampers:

All existing ATC dampers shall be inspected, cleaned, and maintained to proper working order.

### Turning Vanes:

Turning vanes shall be furnished and installed in all 90-degree turns in all supply, return, mixed and fresh air ducts, and elsewhere as shown on the drawings. Install turning vanes in all exhaust ductwork except grease hood exhaust ductwork. Material of turning vanes shall match ductwork. Vanes are to be single blade, of size, spacing, gauge, and fabrication in accordance with SMACNA recommendations.

### INSTALLATION CHECK:

See Section 15100, paragraph "Installation Check".

### EQUIPMENT:

#### Registers, Grilles, and Diffusers:

Registers, grilles, and diffusers of the sizes shown on the drawing and described herein shall be furnished and installed. All grilles, diffusers, and registers shall be complete with frames with rubber gaskets suitable for the area and wall construction where shown on the drawings.

Finish for all registers, diffusers, grilles, etc., shall be off-white unless otherwise selected by the Architect. The successful supplier shall submit color samples to the Architect for his selections before the order is placed. All data shall be certified, and all tests shall be performed in accordance with the requirements of the Air Diffusion Council. For convenience and to establish quality and function, manufacturers and their model numbers are used herein and on the drawings. Items for air distribution shall be Price, Nailor, Metal Air, Tuttle & Bailey, J&J, or Anemostat.

Linear ceiling diffusers shall be Titus TBD 30 with 1-inch blade spacing unless scheduled otherwise, with border type suitable for ceiling type; baked enamel finish, insulated supply plenum. Blades to be adjustable for direction and volume control.

Linear ceiling return air registers shall be Titus TBR 80 with 1-inch blade spacing unless scheduled otherwise, with border type suitable for ceiling type ceiling; baked enamel finish, insulated return plenum.

**Ceiling diffusers grilles and registers shall be independently supported from the structure so that they are not depending on ceiling for support.**

#### Flexible Duct (Low Pressure):

Flexible duct connections from the main trunk ducts to diffuser boots shall be furnished and installed as shown on the drawings. Flexible duct shall be used for supply air ducts only. Flexible ducts shall contain a full inner liner, 1 inch of insulation, vapor barrier, and compression fittings on both ends. Flexible ducts shall connect to trunk duct using high efficiency take offs. A balance damper with locking quadrant will be provided downstream of take-off from trunk duct. Maximum length of flexible duct is 10 feet. Flexible ducts shall be Genflex SLR-25 or Wiremold, Flexmaster, Cody, West or Hercules. Flex duct shall be secured using plastic cinch ties.

Ducts shall conform to the requirements for Class I connectors when tested in accordance with "Standard for Factory Made Air Ducts Materials and Air Duct Connectors" (UL 181). Ducts shall also pass the 15 minute U.L. flame penetration test as specified in the UL 181 Standard.

#### Medium-Pressure Terminal VAV Reheat Boxes:

Complete medium-pressure single-duct variable volume reheat terminal boxes of the size and capacity scheduled on the drawings shall be furnished and installed. Boxes shall be pressure independent pneumatic volume regulation with continuous compensation for pressure fluctuations, from maximum to minimum volumes. Flow sensor shall be multiport type. As per thermostat demand, the regulator will continuously monitor and maintain the required air quantity until thermostat resets the control point. CFM limiting devices are not acceptable. External dials shall permit accurate field adjustments of both the maximum and minimum air volumes. Unit construction shall be 20-gauge galvanized steel with round inlet collars and rectangular outlet collars. Internal surfaces shall be treated with materials which have U.L. approval meeting NBFU and NFPA. Each box shall be fully lined with 1" thick 1.5 lb. density insulation. Sound levels shall not exceed 35 NC at 3.0" S.P. drop based on a 10db room absorption factor for both radiated and discharge sound data. Reheat coils shall have aluminum fins with copper tubes and shall be ARI rated to provide the heating capacity scheduled on the drawings. Boxes to be Trane, Nailor, Titus, Tempmaster, United Air Flow, or Anemostat.

#### Fourth Floor Duct Repair

The contractor shall survey the existing medium pressure duct on the fourth floor (excluding the new finished areas that are shown hatched on drawings) to determine where existing leaks are located. He will have the TAB contractor take a traverse reading of the main supply ducts at full cooling demand and report the cfm's

to the engineer for a leakage calculation. The contractor shall then identify and patch all major and audible leaks as necessary to reduce the leakage amount to a level allowed by Smacna standards for this type of system.

END OF SECTION



DIVISION 15 – MECHANICAL

SECTION 15900  
BUILDING AUTOMATION SYSTEM

GENERAL CONDITIONS:

This project includes upgrading the existing DDC controls and replacing the existing pneumatic controllers. The following specifications represent the existing ATC control schemes and sequences and outline how the new changes are to be incorporated into the overall DDC system. Items not addressed shall be left in the existing form of control. Any items discovered to be missing, in conflict with the new control schemes, or needing to be addressed because of the new changes shall be immediately brought to the engineer's attention. All pertinent sections of this specification may be part of the work described in this section. This contractor will require coordination of other trades. This contractor will have a project manager, with not less than five years experience, on site when ATC work commences to coordinate daily work activities.

SCOPE OF WORK

Add return, typical thru out. Automatic Temperature Controls shall be an extension/upgrade of the Ogden Courts TAC I-Net control system furnished and installed by the local Utah Controls Branch Office.

The Contractor under this heading shall furnish and install a complete direct digital control system as specified.

The temperature controls shall be upgraded, installed and certified by a representative of TAC manufacturer. The installer must have a valid electrical license for the State of Utah. The new TAC Direct Digital Control (DDC) system components shall be tied into the existing TAC system including the Host Computer. This TAC System to operate over the State of Utah Network via NET PLUS Routers.

All of the pneumatic control valves are to be replaced with new control valves and electronic DDC type valve actuators.

All of the pneumatic damper motors are to be replaced with electronic DDC type.

New VFD's will be added to the new Hot Water Pumps and the existing Constant Volume Air Handlers.

Add CO2 and building pressure control to all existing air handlers. Update all ATC control software and review programming.

QUALITY ASSURANCE

This system shall include, but not are limited to, controls and equipment as hereinafter specified:

AHU  
VAV REHEAT BOXES  
CABINET UNIT HEATERS  
UNIT HEATERS  
CHILLER WITH PUMPS  
BOILER WITH PUMPS  
EXHAUST FANS  
SPLIT SYSTEMS  
VFD's FOR CONSTANT VOLUME AHU'S AND HEATING HOT WATER PUMPS  
CONTROL DAMPERS

WORK TO BE PERFORMED BY OTHERS

The Contractor shall carefully review all notes, coordination schedules, and drawings for work required under this section of the specification.

#### Mechanical Contractor

To install all control valves, wells for temperature sensors, and this contractor to supply location and temperature sensors wells.

#### Electrical Contractor

Shall furnish and install all single phase and multiple phase electrical power wiring to magnetic starters, disconnect switches, and motor. Division 16 shall also provide 120 power to each ATC panel as shown on the plans. ATC contractor shall be responsible for step down transformers and 24 VAC wiring to ATC equipment.

#### Sheet Metal Contractor

Shall install all dampers supplied by the ATC contractor. Each damper shall be installed so that it will operate freely and without binding. Each damper shall be checked and those not properly installed shall be replaced or reinstalled without cost to the ATC contractor.

### SUBMITTALS

Prior to any installation, the Contractor shall submit, with 30 days after award of contract, a complete submittal package. This submittal shall contain eight (8) copies of complete literature on all control equipment; including control diagrams and the sequence of operation.

### ACCEPTABLE MANUFACTURERS

Utah Controls-TAC I-Net

### VALVES

ATC valve bodies 2" and smaller shall be screw type; larger valves shall be flanged. Screwed valves shall be rated at 150 psi or greater and shall have cast iron or brass bodies. Flanged valves shall be rated at 250 psi or greater and have cast iron or steel bodies. All automatic valves shall be for DDC control application. All valves shall be disc/plug and seat or ball construction. Valves to be sized for a 3-lb. pressure drop.

Valves shall be Belimo or Honeywell.

### DAMPERS

The ATC contractor shall furnish motorized control dampers. All dampers shall be factory-built, low leakage units such as Ruskin CD-50. Blades shall be 6" maximum width; material to be extruded aluminum, and blade linkage to be external and accessible.

Frames shall be 5" x 1" and made of extruded aluminum hat channel, 0.125" minimum thickness with corner braces to assure that they are square.

Dampers shall be low leakage type with compressible end seals and neoprene of extruded vinyl blade and jamb seals. Leakage shall be not exceeding 6.2 cfm/sq. ft. at 4" W.G. Dampers shall require less than 7#-in/sq. ft. torque at the operating shaft.

### BUILDING MANAGEMENT SYSTEM (BMS)

The building management system shall permit full operator communication and control, including obtaining information about performance of this system; changing times and parameters; adding or deleting points; changing relationships between sensors and controlled equipment; creating or modifying control strategies; and diagnosing system malfunctions. English language prompting format shall be used. The operator will be presented with options at the CRT in English. Features of the system will be compatibility to run on Windows NT, or NT. System to have integrated access control; TCP/IP protocol communication; support for net plus routers; open database support; integrated graphic editor; asynchronous auto-dial/auto answer, and one way dialing. This Contractor shall provide all software required for efficient operation of all the automatic system functions required by this specification. Software shall be modular in design for flexibility in expansion or revision of the system. It is the intent of this specification to require provisions of a system, which can be fully utilized by individuals with no, or limited, previous exposure to PC's and programming techniques and languages. If the system to be provided requires the use of any modified BASIC, "C", PASCAL, or DRUM Language program, or writing "line" programming statements to modify operation or strategy in the system, the vendor shall provide unlimited, no charge, software modification and support for a period of five (5) years after the completion of the project in addition to the warranty period specified elsewhere. Systems, which are factory programmed, are unacceptable. Direct Digital Control (DDC) Modules: Each DCU shall provide "Block" or "Modular" programming software so that the operator can easily develop custom control strategies and sequences of operation, without learning a programming language.

Control loops and sequences shall be defined using "modules" that are analogous to traditional pneumatic or electric control devices. Modules may be linked together to form more complex control strategies. The use of mathematical equations, "BASIC", or proprietary programming languages for defining a DDC control loop is unacceptable.

#### VARIABLE FREQUENCY DRIVES:

Controls contractor to provide all VFD's. Division 16 to install and provide power wiring to the VFD's.

The following VFD manufacturer's equipment have been pre-approved to meet the products section of this specification:

1. Motor Drives International
2. Toshiba
3. Mitsubishi
4. Yaskawa

#### Submittals

1. Submit manufacturer's product data on the VFDs
2. Submit shop drawings including dimension drawings, power drawing, control drawing and operator device layout drawings.
3. Submit harmonic distortion calculations or data for limit guarantees meeting specification requirements.

The VFD shall be supplied as a complete, pre-integrated, stand-alone package produced by a single manufacturer regularly engaged in the production and who maintains full system support responsibility.

1. The VFD system manufacturer shall integrate all components and equipment required to meet these specification features and functions as a single UL labeled system. Vendors providing equipment requiring field integration of separate components shall not be acceptable.
2. Pre-integrated equipment shall include but not be limited to incoming protective equipment, line filters, inverter unit, control circuitry, operator interfaces, bypass arrangement and accessories and auxiliary items required to meet the highest standards for the type of service specified herein.

#### Application

1. Provide VFD units, which are applicable to variable torque fan loads. The entire system unit shall be capable of 110% overload for one minute in the rated environment.

2. Provide equipment that is rated for continuous operation at 4500 feet above sea level in an operating temperature range of 0-40 degrees C.
3. Provide units constructed in an enclosure system rated for indoor environments.

#### Protection

1. Provide short circuit protection by means of an externally operated, door interlocked circuit breaker or motor circuit protector (MCP). Provide provisions for the handle to be locked off to meet NEC requirements.
2. Provide VFD operated motor overload protection by means of programmable, speed sensitive, electronic overload circuits with instantaneous trip, inverse time trip and current limit functions. In the bypass mode, provide motor overload relay set to protect the motor and capable of starting across line.

#### Construction

1. Provide NEMA configuration enclosure for each VFD system. The enclosure shall be either wall mounted or free standing, as required with force ventilation. Mount all components in a single enclosure including, but not limited to, the VFD unit, contactors, door interlocked circuit breaker, bypass/isolating equipment, harmonic filter units, line reactors, and/or other items listed on the specifications or on the drawings.
2. Indoor enclosures shall be NEMA 1 force filter ventilated with an intake air filter to create a positive internal pressure. The air filter must be accessible from the enclosure front and easily changed without shutting down the system.
3. Provide a "machine tool" type control transformer with primary and secondary fusing. All control power shall be 120 volt.
4. Operator Devices: Provide door mounted, industrial type, oil tight operator devices for the following required functions.
  - a. Hand/Off/Auto switch
  - b. VFD/Bypass switch
  - c. Power on light
  - d. VFD run light
  - e. Bypass run light
  - f. VFD fault light
  - g. External fault light
5. Customer Terminations: Provide customer termination points for the following:
  - a. Safeties interlock
  - b. Remote start/stop
  - c. Remote VFD fault annunciation
  - d. Remote motor run annunciation
  - e. Remote speed signal input (0-10vdc or 4-20mA)
6. Bypass: Provide VFD system with a manual bypass contactor arrangement for transfer to the feeder line to operate at constant speed. The contactors shall be electrically and mechanically interlocked with an adjustable motor overload relay.
7. Isolation: Provide a VFD isolation switch or contactor to allow maintenance on the VFD while operating in the bypass mode.
8. Harmonic Mitigation: Provide integrated harmonic distortion mitigating devices designed for the specific VFD to guarantee harmonic distortion limits required herein. VFD system integrated AC reactors, transformers, passive or active harmonic filters or other required devices shall be housed in the single filter ventilated VFD system enclosure isolated by the door interlocked disconnect as a complete UL assembly. Non pre-integrated configurations requiring separate enclosures and components, field mounting, wiring, circuit protection or tuning shall not be permitted. VFD systems shall meet the following THD limits compared to bypass operation:

- a. 5HP and Smaller – VFD systems 5HP and smaller shall include harmonic mitigation to prevent current harmonic distortion (ITHD) from increasing by more than 35% as measured at the VFD system input terminals.
- b. 7.5HP and Larger - VFD systems 7.5HP and larger shall include harmonic mitigation to prevent current harmonic distortion (ITHD) from increasing by more than 15% as measured at the VFD system input terminals.

#### Start-up Services

1. The supplier of the VFD system shall provide field start-up service by an authorized factory trained service representative. The factory representative shall be trained in the maintenance and troubleshooting of the equipment as specified herein. Start-up service shall include system check-out, start-up and system run, and harmonic testing including the following:
  - a. Verify that the system voltage is within the manufacturer's specification tolerances.
  - b. Verify that the motor rotation is correct in all modes of operation
  - c. Verify operator devices, programming and monitoring functions to be fully operational.
  - d. Measure and record system input and output voltage and current at 100% speed. Tune the output voltage to correspond to the motor nameplate data.
  - e. Make all parameter adjustments to tune and optimize the VFD system to the application. Record all configuration values as part of the start-up report.
  - f. Conduct harmonic tests as identified below
  - g. Program each VFD to automatically restart after a momentary power bump, and after an extended power outage.

#### Harmonic Distortion Report

1. After the installation is complete, measure harmonic voltage and current distortion of each VFD system at its highest operating speed. Submit text and graphical data showing voltage and current waveforms in compliance with the harmonic limits specified herein. Submit voltage and current THD as well as individual harmonic spectrum analysis data

#### LOCAL AREA NETWORKS (LAN)

Controller LAN: The FMS shall provide communication between the DCU's over a Local Area Network (LAN).

The Controller LAN shall be a "bus type" network over which information is transmitted in a "token passing" fashion between all the nodes on the network.

The Controller LAN shall have the capacity to contain not less than 64 nodes as a minimum. Each work station, DCU, or "gateway" device shall represent a node to the network.

The Controller LAN shall connect the nodes in a fully distributed environment, each DCU operating autonomously while communicating with all other nodes on the network. Controller LANs requiring a communication controller (for any reason) will not be acceptable. LAN lengths in excess of 24,000 ft. shall be supported.

A break in the communication path of the Controller LAN shall be announced as an alarm and shall automatically initiate a Controller LAN reconfiguration such that the resulting sections of the Controller LAN continue to function as separate LANs. No loss of control shall result from such a break in the Controller LAN.

Commercial LAN: Workstations on the Controller LAN may also reside on a higher tier "commercial" LAN. This "commercial" LAN shall be based on Ethernet, and comply with IEEE 802.3 standards. Where a "commercial" LAN is implemented, it shall be possible to connect multiple Controller LANs together, with global data sharing across this commercial LAN.

Data speed shall not be less than 10 Megabaud.

An operator at a workstation on the "commercial" LAN may connect to any other workstation on the "commercial" LAN as if the operator were sitting at the other workstation.

Alarms and special event notices shall be routed to different workstations on the "commercial" LAN based on time of day, and day of the week.

Operator password assignment shall be available on both a system-wide basis and a workstation by workstation basis.

#### DIRECT DIGITAL CONTROL SYSTEM-OVERVIEW

The direct digital control system shall consist of local microprocessor-based digital control panels (DCP) network together for information sharing and operating convenience and a central operator interface station.

It is the intent of these specifications to create a combined direct digital control system. All system type control functions, such as those used for fan systems, boilers, chillers, central plant and pumps, building pressure, etc., shall be accomplished by using software algorithms in the respective DCP.

Each major mechanical component (fan system, chiller, boiler, etc.) shall have its own dedicated DCP so that failure of any will not result in catastrophic system failure. DCP's utilizing a master-slave relationship shall have a master unit provided for each major mechanical system.

All safety devices such as fire alarm shutdown, smoke detectors, low limit thermostats, etc., shall be hard wired to accomplish their critical functions completely independent of the DCP and shall have additional outputs as required to sever as inputs to the DCP for secondary control and reporting functions.

#### CONTROLLER (DCU)

The controller shall be a microprocessor and shall form the basic control unit of the system. It shall operate as a stand-alone unit providing all the necessary algorithms and software logic to perform the local HVAC control sequences and energy saving functions. Failure of any one DCU shall have no effect on the other DCU's in the system. Programming shall be block type and accomplished by the operator's terminal, or the remote operator terminal. The DCU shall have the ability for direct digital control; automatic time scheduling; demand limiting; calculated points universal inputs with configurable outputs; an RS-485 Lan port; an RS-232 port; an TTL port for hand held console; trend sampling, and on line editing capability. The controller shall operate independent of any central computer, shall have built in diagnostic routines, and shall have 72-hour battery back up.

Inter-computer communications shall support true global token passing control strategies as well as allow data status and values connected to one DCU to be used within application programs of another DCU.

The system shall provide a network communication facility to support global calculation and control strategies to be continuously implemented in the distributed system. The system shall provide for events detected in any area of the total network to initiate commands to any other device within the network. The system shall also provide for connected or calculated data to be continuously shared between any or all controllers within the total network. Through the DCU's may share none critical sensor information, at no

point within the facility shall quick reacting and constantly changing point information be communicated via the network bus. These types of point shall be hardwired to the DCU in which the algorithm exists.

## SOFTWARE

This contractor should provide the most current versions of all-necessary controlling & monitoring software & graphic displays shall be installed. These shall include but not be limited to Microsoft Windows XP, DDC operating system and data files.

Copies of all software releases available within one year of the substantial completion shall be provided and installed to the owner at no cost.

## AIR DUCT SMOKE DETECTORS

Smoke detectors shall be furnished and wired by Division 16. All smoke detectors shall be interlocked with the building fire alarm system by the electrical contractor.

## TEMPERATURE SENSORS

Provide thermistor or thin film silicon sensors for all temperature applications, except differential chilled water for BTU calculation, where precision matched Platinum RTDs shall be used. Solid state sensors shall be linear, drift free, and require only a one-time calibration. A look-up table in the connected controller shall linearize thermistors or similar non-linear temperature devices. Resolution shall be better than .5 degrees F for Micro Controller applications, and better than .2 degrees F for DCP applications.

Space sensors shall have an integral port for connection of a portable "intelligent" sensor to communicate with its DCP. This port and portable "intelligent" sensor may be used for initiating the "test mode" locally to verify all DCP control sequences, and perform test and balancing functions. To eliminate the downtime associated with rechargeable batteries, the portable "intelligent" sensor shall receive its power from the sensor port.

Alta Labs<sup>TM</sup> CO2 Sensor, Carbon Dioxide Sensor, Duct mount model CDL Series. Sensor shall employ non-dispersive infrared technology. (N.D.I.R.) . Repeatability shall be +/- 20 ppm +/- 1% of measured value. Accuracy shall be +/- 30ppm +/-5% of measured value. Sensor response time shall be less than 1 minute. Sensor shall employ reference channel design for long-term stability. Sensor shall have field selectable 0-10VDC, 0-5VDC, or 4-20mA output. Power requirement shall be less than 3W. Input voltage shall be 20 to 30VAC/DC. Operating temperature range shall be 0°C to 50°C. Sensor shall be Veris Industries model CDL. Sensor shall have a field programmable set-point relay. Sensor shall have an LCD standard, displaying CO2 ppm. Sensor shall provide a five-year factory warranty

## PROJECT MANAGEMENT

Provide a project manager who shall, as a part of his duties, be responsible for the following activities.

## SEASONAL ADJUSTMENTS

Seasonal adjustments to the control system will need to be included in this bid. Depending on the finish date this contractor will schedule 8 hours, with maintenance personal to check the system in the mode of either winter conditions or summer.

Provide a designated project manager who will be responsible for the following:

1. Construct and maintain project schedule
2. On-site coordination with all applicable trades and subcontractors
3. Attend project meetings
4. Make necessary field decisions

## WARRANTY

Provide all services, materials and equipment necessary for a one-year period after beneficial use has been established.

## TRAINING

Training will consist of a total of 16 hours. Classes will be broken into 4-hour sessions at the owner's desecration. Owner to give contractor an advance notice of one week before training will commence.

## SEQUENCE OF CONTROL

The following sequences of control are based upon the present sequences programmed into the control system. In addition, new modifications are added which are to incorporated as part of this project. Field verify equipment callouts.

Building static pressure controllers shall be added to the atrium and to each floor of the building. The controls shall modulate the outside air and relief air systems of the air handling units to maintain a minimum building static pressure of 0.05 inches w.g. (adj).

### BASEMENT AIR HANDLER AH-001:

FAN CONTROL: The supply fan shall operate subject to the local safety controls, Central, and local DDC control.

Exhaust Fan (EF-001) shall be interlocked to operate with the Air Handler (AH-001) is operating.

Exhaust Fan (EF-004) shall start when the mixing air economizer damper for AH-001 begin to open and shall remain on until the economizer damper closes.

### FAN LOCAL SAFETY CONTROL:

A low limit temperature sensor located in the leaving air of the hot water coil shall be to start the secondary CHW and HW circulating pumps, close the outside air economizer and minimum dampers, and shutdown the associated fan system. The fan system will remain off until the low limit sensor has been manually reset. A low limit alarm will signal the Network Control Unit and Ogden Regional Operators Workstation.

When the fan system is off the automatic control valves shall remain in control. If the plenum temperatures fall below 40 degrees F the heating valves shall modulate open to the coil and circulating pumps shall be energized as the valves open to maintain the minimum plenum temperature. The automatic outside air dampers shall remain close to the outside air.

DISCHARGE AIR CONTROL: The local Application Specific Controller (ASC) shall modulate the hot and chilled water coil control valves in sequence with the mixed air economizer dampers to maintain the reset discharge air temperature. The discharge air temperature set point shall be reset by the room air temperature.

#### DISCHARGE AIR

65 degrees F

55 degrees F

#### ROOM AIR

68 degrees F

74 degrees F

The relief air damper shall track the outside air economizer damper and shall also be controlled by the building pressurization controllers to maintain the building pressure set point.

### HOT WATER, CHILLED WATER VALVES, AND MIXING DAMPER SEQUENCING:



All control valves and damper motors shall be changed from pneumatic to electronic DDC type.

When the fan is first turned on for the occupied mode the outside air minimum damper shall open. When the discharge air temperature begins to rise above the reset discharge air temperature, the economizer mixing dampers shall be modulated open to provide free cooling. If free cooling is not sufficient, the chilled water valve shall begin to modulate to provide mechanical cooling. When the chilled water valve is modulating the heating valve shall be closed.

The glycol heating water valve shall be modulated open as the discharge air temperature falls below the reset scheduled temperature set point. When the discharge air temperature is satisfied the glycol heating water valve shall be closed and shall not overlap the free cooling economizer or mechanical cooling sequences.

**COIL CIRCULATING WATER PUMP CONTROL:** When the control valves open to the coil the associated coil circulating pump shall run. When the control valve closes to the coil the pump shall be de-energized.

The coil circulating pumps shall operate continuously whenever the low limit sensor has tripped or when the outside air temperature is below 35 deg. F.

#### **ASSOCIATED HEAT EXCHANGER (HX-3):**

A 2-way valve in the hot water supply to the heat exchanger shall be interlocked with the coil circulating pump. When the pump is off the valve shall be closed.

**MIXED AIR CONTROL:** A mixed air temperature sensor through the DDC will override the outside air dampers to limit the mixed air from going below 50 deg. F.

**ECONOMIZER CONTROL:** A temperature sensor located in the outside air shall, through the DDC panel, return the outside air economizer damper to the closed position whenever the outside air temperature is above 78 deg. F.

The minimum outside air and return air dampers will be furnished by the ATC Contractor. The ATC Contractor will be responsible to furnish and install the damper actuators.

See Smoke Evacuation for alternate control.

#### **VAV AIR HANDLERS AH-101, 201, 301, AND 401:**

**FAN CONTROL:** The supply and return fan shall operate subject to the local safety controls, Central, and local DDC control.

The fan system manual bypass timer shall allow the building occupant to override the Central Control and Monitoring Station schedules and allow the occupied mode of the fan to be initiated.

During the unoccupied mode the area sensor, located in rooms, shall intermittently cycle the associated fan to maintain the night set back temperature of 62 deg. F.

**FAN LOCAL SAFETY CONTROL:** A low limit temperature sensor located in the leaving air of the hot water coil shall be to start the secondary CHW and HW circulating pumps, close the outside air economizer and minimum dampers, and shutdown the associated fan system. The fan system will remain off until the low limit sensor has been manually reset. A low limit alarm will signal the Network Control Unit and Ogden Regional Operators Workstation.

A high limit static pressure switch with manual reset shall be hard wired to stop the supply fan whenever the static pressure at the fan system discharge exceeds 3.5 inches of water

(adjustable). A high static alarm will signal the Network Control Unit and Ogden Regional Operators Workstation.

When the fan system is off the automatic control valves shall remain in control. If the plenum temperatures fall below 40 deg. F the heating valves shall modulate open to the coil and circulating pumps shall be energized as the valves open to maintain the minimum plenum temperature. The automatic outside air dampers shall remain closed to the outside air.

DISCHARGE AIR CONTROL: The DDC shall modulate the hot water, chilled water coil control valves in sequence with the mixed air economizer dampers to maintain the reset discharge air temperature. The discharge air temperature set point shall be reset by the return air temperature.

DISCHARGE AIR

65 degrees F

55 degrees F

RETURN AIR

70 degrees F

74 degrees F

The relief air damper shall track the outside air economizer damper and shall also be controlled by the building pressurization controllers to maintain the building pressure set point.

HOT AND CHILLED WATER VALVES AND MIXING DAMPER SEQUENCING:

All control valves and damper motors shall be changed from pneumatic to electronic DDC type.

When the fan is first turned on for the occupied mode the outside air minimum damper shall open. When the discharge air temperature begins to rise above the reset discharge air temperature the modulating mixing economizer dampers shall be modulated open to provide free cooling. If free cooling is not sufficient, then the chilled water valve shall begin to modulate to provide mechanical cooling provided chilled water is available. When the discharge air temperature begins to drop below the reset discharge air temperature the modulating mixing economizer dampers shall be modulated closed and the glycol heating water valve shall begin to open.

COIL CIRCULATING WATER PUMP CONTROL: When the control valve opens to the coil, the associated coil circulating pump shall run. When the control valve closes to the coil, the pump shall be de-energized.

The coil circulating pumps shall operate continuously whenever the low limit sensor has tripped or when the outside air temperature is below 35 deg. F.

MIXED AIR CONTROL: A mixed air temperature sensor through the DDC will override the outside air dampers to limit the mixed air from going below 50 deg. F.

CO2 CONTROL: The scheduled minimum damper position shall be adjusted as the CO2 sensor in the space exceeds 800 ppm. The CO2 sensor shall be located in the return air duct served by each fan system and shall be mounted to be accessible. Sensor to have a LCD display.

ECONOMIZER CONTROL: A temperature sensor located in the outside air shall, through the DDC panel, return the outside air economizer damper to the closed position whenever the outside air temperature is above 78 deg. F.

DUCT STATIC PRESSURE CONTROL: The duct static sensor shall be located 2/3 down the longest duct from the supply fan. As the duct static decreases the Variable Speed Drive (VFD), furnished and installed by this Division, shall vary the speed of the fan to maintain duct static setpoint. When the fans are shut off the VFD's shall be indexed to the zero speed mode.

A -0.25 to 0.25"wc static pressure transmitter with an outside probe, and an interior probe located in the lobby area, acting through the DDC system shall modulate the relief dampers in sequence to maintain 0.05"wc building static pressure. The relief dampers are closed when the fans are not running.

The associated Return Fan shall be started 2 minutes after the Supply Fan has indicated fan operation. When the Return Fan indicates operation, the ASC shall track the Return Fan VFD with the Supply Fan VFD.

See Smoke Evacuation for alternate control.

CONSTANT VOLUME AIR HANDLERS: AH-202, 203, 204, 205, 302, 303, 304, 305, 402, 403, 404, 405:  
FAN CONTROL: The supply and return fan shall operate subject to the local safety controls, Central, and local DDC control. VFD's furnished by this section will be added to both the supply fans and return fans. These vfd's will be used so the fans can operate like two speed fans. When the zone served by these fans is occupied the fans will be at 100%. When they are not occupied the VFD will set back the fan speed to 50% (adjustable). Occupancy shall be determined either by occupancy schedules or by room occupancy sensors. When building goes into fire alarm the VFD shall set fan speed to 100%.

#### FAN LOCAL SAFETY CONTROL:

A low limit temperature sensor located in the leaving air of the hot water coil shall be to start the secondary CHW and HW circulating pumps, close the outside air economizer and minimum dampers, and shutdown the associated fan system. The fan system will remain off until the low limit sensor has been manually reset. A low limit alarm will signal the Network Control Unit and Ogden Regional Operators Workstation.

When the fan system is off the automatic control valves shall remain in control. If the plenum temperatures fall below 40 deg. F the heating valves shall modulate open to the coil and circulating pumps shall be energized as the valves open to maintain the minimum plenum temperature. The automatic outside air dampers shall remain closed to the outside air.

DISCHARGE AIR CONTROL: The DDC shall modulate the hot and chilled water coil control valves in sequence with the mixed air economizer dampers to maintain the reset discharge air temperature. The discharge air temperature set point shall be reset by the room air temperature.

<u>DISCHARGE AIR</u>	<u>ROOM AIR</u>
65 degrees F	68 degrees F
55 degrees F	74 degrees F

The relief air damper shall track the outside air economizer damper and shall also be controlled by the building pressurization controllers to maintain the building pressure set point.

#### HOT WATER, CHILLED WATER VALVES, AND MIXING DAMPER SEQUENCING:

All control valves and damper motors shall be changed from pneumatic to electronic DDC type.

When the fan is first turned on for the occupied mode the outside air minimum damper shall open. When the discharge air temperature begins to rise above the reset discharge air temperature, the economizer mixing dampers shall be modulated open to provide free cooling. If free cooling is not sufficient, the chilled water valve shall begin to modulate to provide mechanical cooling. When the chilled water valve is modulating the heating valve shall be closed.

The glycol heating water valve shall be modulated open as the discharge air temperature falls below the reset scheduled temperature set point. When the discharge air temperature is satisfied

the glycol heating water valve shall be closed and shall no overlap the free coiling economizer or mechanical cooling sequences.

**COIL CIRCULATING WATER PUMP CONTROL:** When the control valves open to the coil the associated coil circulating pump shall run. When the control valve closes to the coil the pump shall be de-energized.

The coil circulating pumps shall operate continuously whenever the low limit sensor has tripped or when the outside air temperature is below 35 deg. F.

**MIXED AIR CONTROL:** A mixed air temperature sensor through the DDC will override the outside air dampers to limit the mixed air from going below 50 deg. F.

**ECONOMIZER CONTROL:** A temperature sensor located in the outside air shall, through the DDC panel, return the outside air economizer damper to the closed position whenever the outside air temperature is above 78 deg. F.

**CO2 CONTROL:**The scheduled minimum damper position shall be adjusted as the CO2 sensor in the space exceeds 800 ppm. The CO2 sensor shall be located in the return air duct served by each fan system and shall be mounted to be accessible. Sensor to have a LCD display.

The minimum outside air and return air dampers will be furnished by the ATC Contractor. The ATC Contractor will be responsible to furnish and install the damper actuators.

See Smoke Evacuation for alternate control.

**BUILDING AND TOILET EXHAUST CONTROL Existing (No work required):**

Exhaust Fans (EF-101, 403, 404, 405). To operate during the weekly occupied schedule for fan operation, the Exhaust Fans shall be started to operate when the associated Supply Fan is operating. During the unoccupied mode the exhaust fans shall remain off.

**BASEMENT AREA DUCT MOUNTED REHEAT COIL CONTROLS:**

Change the pneumatic room thermostats and valves to electronic DDC and modulate the reheat coil control valve to maintain the room temperature. The ATC Contractor shall furnish and install, discharge air sensors.

**VAV BOX CONTROLS:**

**PNEUMATIC VAV BOXES WITH REHEAT:** Change the pneumatic room thermostats and valves to electronic DDC. Motion Sensors will be added by Division 16, controls contractor to tie in the VAV box controls to occupy the space when motion as been detected otherwise the box will remain in the un-occupied mode. For boxes that serve more than one occupied zone, the box will remain in occupied mode if any one of the sensors connected to the box detects motion, and will go to un-occupied mode only when all of the occupancy sensors connected to the box are not detecting motion. Override the motion sensors for building warm up until 8:30 A.M.

Vav boxes serving the Atrium shall have dual maximum control so than in the heating mode the box cfm will modulate higher towards 100% together with the reheat valve modulating open.

The VAV Box flow sensors velocity controllers pneumatic tubing, damper and damper actuator shall be factory furnished by the VAV Box supplier.

The thermostat shall modulate the VAV Box damper to the minimum CFM position and the reheat valve open to maintain the room temperature.

When the room temperature rises above the room thermostat set point the reheat valve shall be modulated closed and the vav box damper shall be modulated open to maintain the room temperature.

The controller shall modulate the VAV box primary air damper between minimum ventilation position and maximum designed airflow. The VAV serving the space shall modulate the reheat coil valve and damper to maintain set point. Heating and cooling setpoints shall be individually adjustable from the man-machine interface device, the Ogden Regional Operators Workstation.

The primary air damper of the VAV box shall be capable of reversing operation as required for building warm-up or central plant heat applications.

Each VAV box DDC controller shall have a 24-volt power connection with all 24-volt control wiring by the ATC contractor. Transformers for the VAV controllers shall be centrally located for easy access.

The ATC Contractor shall furnish and install, in conduit, a communication trunk for remote software programming, monitoring and temperature set point adjusting to each of the electronic controller.

**DIRECT DIGITAL VAV BOX CONTROLS:** Replace each of the existing ddc vav box (i.e. Judges Chambers, etc.) controllers to the latest version. Sensors will be added by Division 16, controls contractor to tie in the VAV box controls to occupy the space when motion has been detected otherwise the box will remain in the un-occupied mode. Override the motion sensors for building warm up until 8:30 A.M. Each box shall be controlled and monitored through an electronic ASC controller with a local override switch.

When the room temperature falls below the controllers set point as sensed by the room sensor, the DDC controller shall modulate the VAV Box damper to the minimum CFM position and the reheat valve open to maintain the room temperature.

When the room temperature rises above the room thermostat set point the reheat valve shall be modulated closed and the vav box damper shall be modulated open to maintain the room temperature subject to the VAV Box controllers maximum CFM setting.

VAV Boxes from the local building Network Control Unit or Ogden Regional Operators Workstation.

Each of the electronic VAV Box points listed below shall continuously have a past 24 hour point history output at the local NCU, for remote monitoring and temperature tracking from the Ogden Regional Workstation.

An override switch, located at the room sensor, shall be provided to all spaces to return the occupied temperature setpoint when initiated. When the override switch is energized the associated supply fan shall be started.

Upon completion of the VAV Box system start-up and verification the ATC Contractor shall assist the Air Balancing Contractor with the programming tools and instruction necessary to balance the system. The past 24 hour point history tracking feature shall be initiated and demonstrated to the Ogden Regional personnel for remote monitoring.

#### BASEBOARD RADIATION CONTROL:

The baseboard radiation valves shall be changed to electronic 2 position and controlled by the respective VAV Box room thermostat or DDC controller in sequence with the reheat valve. The baseboard radiation valve shall be the first stage of heating when associated with a VAV Box.

Radiant heating will be added at the Main security area and the main entrance vestibule. Add the necessary electronic controllers and valves to control this equipment.

GAS FIRED UNIT HEATERS (No work required):

The electric room thermostat on a call for heating shall energize the factory furnished heater fan, open the gas valve subject to the units factory furnished safety controls to maintain the room temperature.

HOT WATER UNIT HEATERS (No work required):

The electric room thermostat shall on a call for heating open the two position normally closed hot water valve and energize the fan. When the space temperature is satisfied the valve shall be closed and the fan shall be off.

STAIRWELL HEATING:

Change the pneumatic room thermostats and valves to electronic DDC located on the first level, to modulate the heating valve to maintain set point temperature.

HOLDING CELLS RESTROOMS EXHAUST (No work required):

The exhaust fans (EF-401 and 402) shall be on during the occupied mode and shall be off during the unoccupied mode.

SALLY PORT RAMP ENTRANCE EXHAUST (No work required):

A carbon monoxide detector shall energize the Exhaust Fan (EF-5), open the outside air intake and exhaust dampers when the build-up of carbon monoxide exceeds the detectors set point. The fan shall remain on until the carbon monoxide levels have reached safe levels. When the exhaust fan is off the dampers shall be closed.

SPLIT SYSTEMS

ATC Contractor to wire factory furnished temp sensor and condenser controls. Condensing units will be located on the roof.

CHILLER ROOM VENTILATION (No work required):

A room thermostat shall energize the chiller room exhaust fan, open the outside air intake and exhaust dampers when the space temperature exceeds 80 deg. F. When the room temperature drops below 62 deg. F, the chiller room unit heater valve will be modulated open. A strap-on aquastat located on the hot water return line will lock out the unit heater fan when no hot water is present.

AIR CONDITIONING UNIT (AC-001) (No work required):

Furnish and install an electric stand-alone Unitary Controller (UC), to control the air conditioning units. The UC will monitor the space sensor and cycle the air conditioning unit fan and energize the solenoid chilled water to maintain space temperature set point.

Provide continuous past 24 hour point history of the Elevator Equipment Room space temperatures and fan operation, at the local NCU for remote monitoring and alarming.

SEWAGE EJECTOR ALARM (No work required):

The sewage ejector duplex pumps shall be furnished by the supplier with set of high level alarm contacts for remote alarming. Indicate high level alarm reporting at the Ogden Regional Workstation and provide continuous past 24 hour point history for problem monitoring and alarming.

#### HOT WATER SUPPLY SYSTEM:

##### **BOILERS B-1 AND B-2:**

All control valves and damper motors shall be changed from pneumatic to electronic DDC type.

The boilers shall operate in the automatic mode. The boilers are a package boiler system with control panel, sensors, firing relays. The ATC Contractor shall be responsible for installing the wall mounted boiler control panel and installing low voltage (below 100 vac) interlock temperature control wiring from the boilers to the control panel. The local and remote operator shall be able to enable/disable the boilers from operating. Provide operating status of each boiler, with continuous 24 hour past history reporting at the local NCU.

**HOT WATER PUMPS P-1 AND P-2:** These pumps will be replaced and VFD's added to them. They both will operate when any portion of the building is indexed to the occupied mode and the outside air temperature is below 70 deg. F (adjustable). Should the any pump fail an alarm will be sent to the BMS computer. Pump speeds will be indexed by water differential pressure sensors, see plans for locations.

The two hot water pumps shall be controlled by VFD's. Analog differential pressure transmitters mounted across the return and supply piping shall through the BAS system modulate the VFD's to maintain the minimum pressure at the differential pressure transmitters. See drawings for dpt locations.

In the occupied mode the pumps shall run together and shall start at a minimum 30% speed each. The pump speed shall increase and decrease together based upon the signal from the differential pressure transmitters to maintain the pressure set points. As the pressure decreases, the dpt signals the pumps speed to increase. As the pressure increases, the dpt signals the pumps speed to slow down.

The opening and closing of the individual ATC valves creates the variable flow in the system. Several 3-way ATC valves in the system prevent pumps from deadheading.

In the unoccupied mode, if an area is calling for heat, then the pumps shall be started also. The pumps shall be controlled in a similar manner as described above.

Neither pump VFD's or Motors will be operated below their recommended minimum speed. The ATC contractor shall provide sensors to monitor the pressure in the heating system.

#### COMBUSTION AIR CONTROL (No work required):

When the boiler receives a signal to fire, the combustion air damper shall be opened first. When the combustion air damper end switch indicates the damper is open, the boiler shall be enabled and operate under the factory furnished firing controls and safety devices.

#### HOT WATER TO GLYCOL HEAT EXCHANGERS (Serving Flrs 1-4 AH Units) (HX-1):

When the outside air temperature is below 50 deg. F, the lead circulating pump shall be energized. If the lead pump fails to provide flow, as sensed by the pumps differential pressure switch, for 30 seconds after being energized, the standby pump shall be turned on. The standby pump shall remain on until the control process has been reset by the facility operator.

2 The DDC will monitor the glycol hot water supply temperature and modulate the hot water valve  
4 to maintain set point. When the circulating pumps are not operating the hot water valve shall be  
6 closed.

#### 8 CHILLED WATER PLANT:

10 All control valves and damper motors shall be changed from pneumatic to electronic DDC type.

12 When the outside air temperature rises above 65 deg. F the chilled water pump shall be  
14 energized. The chilled water flow switch wired in series with the chilled water pump starter shall  
interlock the chiller to start. The chiller shall operate subject to the factory furnished safety  
controls.

16 The chiller shall internally stage on the needed stages of refrigeration to maintain the chilled  
18 water supply temperature.

20 A standby pump will be manually operated by the local operator should either the condenser or  
22 chilled water valve fail. The operator shall manually open the respective bypass valve and  
manually start the pump at the local magnetic starter. Install a current sensor in indicated pump  
status. When the pump is started, an alarm indication at the local NCU and remote workstation  
will indicate the standby pump has been manually started.

24 The DDC will start the cooling tower fan in low speed. As temperature continues to increase, the  
26 DDC shall index the cooling tower from low speed to high speed as needed to maintain the  
condenser water temperature.

28 The cooling tower shall be furnished with a sump heater package and low sump level water  
30 controller. The ATC Contractor shall furnish the fill water valve and interlock to the sump level  
32 controller. When the tower fan is off and the drain valve has been opened, the heater shall be  
de-energized. The drain valve and fill shut off valve shall be operated to drain the tower sump  
when the outside air temperature falls below 40 deg. F. The tower fan shall remain off, the drain  
34 valve open and fill closed until the outside air temperature reaches 60 deg. F.

#### 36 WATER SOFTENER (No work required):

38 The water softener and accessory components will be furnished and installed by the Mechanical  
40 Contractor. The ATC Contractor shall install the interlock wiring between the controller and  
valve. Power wiring to the controller will be furnished by the Electrical Contractor under Division  
16000.

#### 42 GLYCOL MAKE-UP WATER (No work required):

44 The glycol make-up tank, circulating pump, sensors, and solenoid valves will be furnished and  
46 installed by the Mechanical Contractor. For Heat Exchanger (HX-1), the ATC Contractor shall  
interlock the sensor to open the valve and cycle the pump. HX-3 has two separate sensors and  
48 valves that need to be interlocked and cycle the pump.

#### 50 SNOW MELT SYSTEM (No work required):

52 The snow melting system will be a Techmar packaged system.

54 The Mechanical Contractor shall furnish the controller and associated equipment to the ATC  
Contractor. The ATC Contractor shall mount the panel and wire the outdoor and slab  
56 temperature sensors to the controller.



The ATC Contractor shall furnish a 2-way valve in the snow melt heat exchanger supply line and interlock to close when the circulating pump is not operating.

Furnish and install a snow melt enable/disable Binary Output point to allow the remote operator to override the snow melting controller.

Smoke rated dampers with end switches at the south intake louver 1<sup>st</sup> level, 4<sup>th</sup> level and at the elevator shafts. Dampers to open when their respective exhaust fan is on.

#### FLOOR HOT WATER HEATING CONTROL (No work required):

Furnish and wire floor sensor, where shown on the mechanical drawings, back to a local ASC controller. The local ASC will monitor the floor sensors and cycle the associated Recirculating Pump (RP-1, 2, 3, 4) to maintain floor slab temperature of 65 deg. F. Provide a Set Point Adjust and Binary Output points, to allow the remote operator to lock out each of the RP pumps or adjust the floor slab set point.

#### SMOKE EVACUATION CONTROL SYSTEM (existing but add equipment as noted):

The following shall be added to the existing smoke control system. A new panel shall be added along with the old one to accomplish this control:

Smoke rated dampers with end switches at the intake louver 1<sup>st</sup> level and discharge louver on the 4<sup>th</sup> level (see plans for size and location). Dampers to open when their respective exhaust fan is on.

Smoke rated dampers with end switches at the elevator shafts vents. Dampers to open when their respective exhaust fan is on.

The existing DDC networked system is UL 864 Smoke Evacuation and Control listed.

**FIRST FLOOR ATRIUM MAKE-UP AIR AND EXHAUST FAN SYSTEM:** The Electrical Contractor, under Division 16000, will furnish and install at each floor mechanical room ATC Panel a fire alarm zone indication relay.

The Sheetmetal Contractor will furnish and install the combination smoke/fire dampers with electric actuators. The Electrical Contractor will wire the electric actuators back to the basement ATC Panel for interlocking by the ATC Contractor.

When the zone relay is in alarm the following events shall occur:

##### VAV Fan:

- a. Supply Fan shall be started.
- b. VFD ramped to full speed.
- c. Return Fan stopped.
- d. The outside economizer and relief damper will be opened.
- e. Hot water circulating pump will be started.
- f. The low limit temperature sensor locked out from stopping the fan.

##### Courtroom Fans:

- a. Supply Fan shall be started.
- b. Return Fan stopped.
- c. The outside economizer air and relief air damper will be opened.
- d. Hot water circulating pump will be started.
- e. The low limit temperature sensor locked out from stopping the fan.

Atrium and Adjacent Floor Space:

- a. The VAV boxes serving the Atrium for this floor and adjacent areas surrounding the Atrium shall open.
- b. The VAV boxes not adjacent to the Atrium, the dampers will go open.
- c. When any of the floors (1 thru 4) are in zone evacuation alarm the Make-up Air Supply Fan (SF-101) outside air damper shall be opened. When the DDC verifies the damper has proven open, by an end switch mounted on the damper blade, the DDC will start SF-101. Indicate fan status at the Fire Fighter Panel, local NCU and remote workstation.
- d. Atrium Exhaust Fan (EF-501) shall be started. Indicate fan status at the Fire Fighters Panel, local NCU and the remote workstation.

**BASEMENT AREA EXHAUST:** The Electrical Contractor, under Division 16000, will furnish and install at the Basement ATC Panel three (3) separate smoke zone indication relays to be energized by the Fire Alarm Panel.

The Sheetmetal Contractor will furnish and install the combination smoke/fire dampers with electric actuators. The Electrical Contractor will wire the electric actuators back to the basement ATC Panel for interlocking by the ATC Contractor.

When any of the Basement Area zone relays are in alarm the Supply Fan shall be started, the outside economizer air damper will be open, the hot water circulating pump will be started and the low limit temperature sensor locked out from stopping the fan.

When the Zone Fire Alarm Relay is energized, the respective zone, the associated basement exhaust fan shall be energized, and the duct mounted smoke dampers shall be positioned to cause the surrounding areas of the affected zone to be positively pressurized and the affected area to be negatively pressurized.

**FIRE FIGHTERS COMMAND PANEL (FFCP):** Located on the First Level, see Mechanical Drawings, furnish and install a FFCP to monitor and control the equipment listed below.

The FFCP panel face shall be blank with a key-locking door. A red tag shall be mounted on the face of the panel stating "FIRE FIGHTERS COMMAND PANEL". Inside the panel install a subbase plate to mount the override switches and indication lights listed below. Next to the panel. mount a "break glass" key box to house the FFCP panel key. Give two (2) spare keys to the Ogden Regional Building Manager.

Override Switches:

Air Handling Units (separate switch each)	On-Off-Auto
Atrium Make-up Air Fan	On-Off-Auto
Atrium Exhaust Fan	On-Off-Auto
Basement Exhaust Fans 1, 2, 3, & 4 (separate)	On-Off-Auto
Pilot Light Test Switch	On-Off

Indication Lights:

Air Handling Units (separate light)	Green "On"
Atrium Make-up Air Fan	Green "On"
Atrium Exhaust Fan	Green "On"
Basement Exhaust Fans 1, 2, 3, & 4 (separate)	Green "On"

Each override switch shall have a separate tag listing the fan system number and floor level served. Each indication light shall have a separate tag listing the fan system number and stating "Green-Fan On", "No Light-Fan Off".

2 ATC AIR COMPRESSOR: The existing atc air compressor shall be evalulated to determine is all  
4 compressed air needs have been removed by the new ddc controls. If any compressed air needs  
remain, they shall be discussed with the owner.

6 ELEVATOR SHAFT ATC DAMPER: The ATC damper shall be a powered closed, normally open damper,  
8 and shall be interlocked with the lobby smoke detectors to open upon smoke detector activation.

10 END OF SECTION

## SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Supporting devices for electrical components.
  - 2. Access Panels
  - 3. Electrical demolition.
  - 4. Cutting and patching for electrical construction.
  - 5. Touchup painting.

#### 1.3 SUBMITTALS

- A. Submittal Procedures: Submittal procedures are specified in Division 1.
  - 1. Prepare submittals in three-ring "hard cover" binders with project name and volume on the binding. Include tabs identified by the specification section and in numerical order. Include plastic sleeves to hold drawings that exceed 8-1/2" x 11".
  - 2. Include cover sheet with the following information: date, project name, address, and title; Installer's name, address and phone number; Project manager, and Engineering firm names and phone numbers.
- B. Project Record Documents: Project Record Documents are specified in Division 1.
  - 1. Redline changes or information recognized to be of importance to the Owner. Include wiring changes, panelboard changes, etc.
  - 2. Dimension underground wiring and other concealed electrical features.
  - 3. Redline actual equipment electrical characteristics on equipment schedules.
- C. Digital Operation and Maintenance Manual on CD-ROM
  - 1. Intuitive CD-ROM instructional manual for information to care, adjust, maintain and operate equipment. Include contract documents, shop drawings, product data.
    - a. Software: Adobe Acrobat.
    - b. Format: PDF.
    - c. Index: Hypertext alphabetical index.
    - d. Auto Starting: Windows 9X with any directions to continue observable on the screen.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Comply with Owner Standards.
  - 1. State of Utah, Division of Facilities Construction and Management "Design Criteria".

- D. Installer Qualifications: All workmen doing electrical work shall be duly licensed with the required supervision in the State or Locality as legally required.
  - 1. Site Review: All electricians must carry their electrician's license with them and show it upon request.

## 1.5 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical equipment installation with other building components.
  - 1. Verify all dimensions be field measurements.
  - 2. Minimize costs to resolve equipment and other conflicts by successfully concluding preinstallation conferences. Include the following:
    - a. Review Division 15 shop drawings. Compare equipment electrical specifications with equipment schedule. Prevent Div 15 equipment encroaching on clearances required by NEC. Request clarification of conflicts prior to installation.
    - b. Determine whether lighting fixtures and other electrical items conflict with the location of structural members and mechanical or other equipment.
    - c. Coordinate connecting electrical service to components furnished in other sections of the specification or by the User. Verify electrical requirements including voltage, full load amps, and minimum wire ampacity prior to installing or purchasing the associated electrical equipment and wiring.
    - d. Review systems furniture electrical specifications and compare with wiring indicated. Request dimensional layout from furniture installer including electrical connection locations. Request clarification of conflicts prior to installation.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Coordinate with Authorities Having Jurisdiction including: city, county, state, university, federal and other governmental authorities.
  - 1. Obtain all permits (including excavation permits) prior to beginning construction.
  - 2. Pay all fees.
  - 3. Request inspections required by Authorities Having Jurisdiction in a timely manner and in order to comply with sequencing requirements.

## PART 2 - PRODUCTS

### 2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.

1. Channel Thickness: Selected to suit structural loading.
  2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
  - E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
  - F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
  - G. Expansion Anchors: Carbon-steel wedge or sleeve type.
  - H. Toggle Bolts: All-steel springhead type.
  - I. Powder-Driven Threaded Studs: Heat-treated steel.
- 2.2 TOUCHUP PAINT
- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
  - B. For Nonequipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
  - C. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## PART 3 - EXECUTION

### 3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.
- E. Existing Utilities: Locate and identify existing underground utilities in excavation areas or in demolition areas. Maintain services to areas outside demolition limits or excavated areas. When services must be interrupted, install temporary services for affected areas.
- F. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements indicated in the Contract Documents.
- G. Record drawings and Shop Drawings: Mark up drawings daily during construction with changes or deletions in the scope of the project.

### 3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of **200-lb (90-kg)** design load.

### 3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
  - 1. Comply with NFPA 70. In addition, install supports within 12" of couplings, fittings, and boxes, with a minimum of two supports per 10 foot length of raceway. Install supports at each change of direction. Similarly support cables in cable trays or raceways as indicated; except, provide J-hooks to support cables.
  - 2. Support suspended conduit and cables independently from all other electrical or mechanical systems by attaching directly from building structure, unless prior approval in writing has been obtained from the Architect after engineering calculations have been submitted.
  - 3. Coordinate installation of supports so as not to interfere with the removal of ceiling tiles, the service of mechanical equipment, etc.
  - 4. Install bracing parallel to trusses, beams, joists, bridging, etc.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Support parallel runs of cables together on trapeze or bracket type hangers, either vertically or horizontally.
- E. Size supports for multiple raceway and cable installations so capacity can be increased by a 25 percent minimum in the future.
- F. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- G. Install **1/4-inch- (6-mm-)** diameter or larger threaded steel hanger rods, unless otherwise indicated.
- H. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- I. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- J. Simultaneously install vertical conductor supports with conductors.

- K. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If supported directly from the building structure, attach box to framing on opposite sides of the box. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than **24 inches (610 mm)** from the box.
- L. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- M. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
  - 1. Install wrapped or coated RMC sleeves with 3 feet extending on each side through penetrations of foundations or concrete walls by RNC.
- N. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - 4. Existing Concrete: Expansion bolts. Drill holes in concrete so holes do not cut main reinforcing bars. Fill and seal holes drilled in concrete and not used.
    - a. Obtain prior approval from project structural engineer prior to drilling prestressed or post-tension concrete slabs and beams.
  - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
  - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
    - a. Field Welding: Comply with AWS D1.1.
  - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
  - 8. Light Steel: Sheet-metal screws.
  - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load. Do not support electrical equipment or conduits with toggle bolts, moly-bolts, or screws in sheetrock or plaster. Do not support electrical equipment or conduit from tie wires.
  - 10. Do not use wooden plugs in concrete or masonry units for fastening conduits, tubing, boxes, cabinets, etc.

### 3.4 ACCESS DOORS

- A. Install access panels where required by accessibility requirements of NEC for electrical installations such as junction boxes, ballasts, and other electrical equipment requiring access.

### 3.5 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."
- B. Gypsum Board Tenting: Apply to lighting fixture or electrical equipment penetrations of fire rated floor, ceiling and wall assemblies, unless product is UL listed with integral fire rating



Perform tenting as specified in appropriate Division 9 section to reestablish the original fire-resistance rating of the assembly at the penetration.

### 3.6 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
  - 1. Relocate existing electrical devices, conduit or equipment that for any reason obstructs construction. Include any equipment having electrical connections that requires disconnecting and reconnection at the same or another location throughout the course of construction.
  - 2. Maintain in working condition all electrical equipment and apparatus in areas not remodeled.
  - 3. Temporary Partitions or Dust Barriers: Prevent the spread of dust and dirt to adjacent areas.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
  - 1. Include exposed equipment and installations made obsolete by new work.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove and legally dispose of demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
- F. Remove conductors from raceway to the first active outlet or branch panels for vacated or unused circuits.

### 3.7 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
  - 1. Core drilling: X-Ray post-tension slabs prior to core drilling to assure that post-tension cables are not damaged.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

### 3.8 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Supporting devices for electrical components.
  - 2. Electrical demolition.
  - 3. Cutting and patching for electrical construction.
  - 4. Touchup painting.
- B. Test all electrical work to ensure that they test free of mechanical and electrical defects.
  - 1. Comply with testing requirements of authorities having jurisdiction.
  - 2. Comply with Owner's standards for testing in documents listed in "Quality Assurance".

### 3.9 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
  - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
  - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.10 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
  - 1. Remove labels that are not permanent labels.
  - 2. Wipe surfaces of electrical equipment. Remove excess lubrication and other substances.
  - 3. Clean exposed exterior and interior hard-surface finishes to a dust-free condition, free of stains, films and similar foreign substances.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 16050

## SECTION 16060 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

#### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Ground rods.
- B. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grounding Conductors, Cables, Connectors, and Rods:
    - a. Apache Grounding/Erico Inc.
    - b. Boggs, Inc.
    - c. Chance/Hubbell.
    - d. Copperweld Corp.
    - e. Dossert Corp.
    - f. Erico Inc.; Electrical Products Group.
    - g. Framatome Connectors/Burndy Electrical.
    - h. Galvan Industries, Inc.
    - i. Harger Lightning Protection, Inc.
    - j. Hastings Fiber Glass Products, Inc.
    - k. Heary Brothers Lightning Protection Co.
    - l. Ideal Industries, Inc.
    - m. ILSCO.
    - n. Kearney/Cooper Power Systems.

- o. Korns: C. C. Korns Co.; Division of Robroy Industries.
- p. Lightning Master Corp.
- q. Lyncole XIT Grounding.
- r. O-Z/Gedney Co.; a business of the EGS Electrical Group.
- s. Raco, Inc.; Division of Hubbell.
- t. Robbins Lightning, Inc.
- u. Salisbury: W. H. Salisbury & Co.
- v. Superior Grounding Systems, Inc.
- w. Thomas & Betts, Electrical.
- x. VFC, Inc.

## 2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Material: copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- H. Copper Bonding Conductors: As follows:
  - 1. Bonding Conductor: as noted on the drawings, stranded copper conductor. Comply with NEC minimum requirements.
  - 2. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; **1-5/8 inches (42 mm)** wide and **1/16 inch (1.5 mm)** thick.

## 2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Sectional type; copper-clad steel.
  - 1. Size: **3/4 by 120 inches (19 by 3000 mm)** in diameter.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Underground Grounding Conductors: Use tinned- copper conductor, No. 2/0 AWG minimum. Bury at least **24 inches (600 mm)** below grade or bury **12 inches (300 mm)** above duct bank when installed as part of the duct bank.

### 3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and branch wiring.
- C. Nonmetallic Raceways: Install an equipment-grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- D. Air-Duct Equipment Circuits: Install an equipment-grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment-grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

### 3.3 INSTALLATION

- A. Renovation Projects: Document existing ground system at the main service and at each separately derived system serving the renovated area. Correct deficiencies of existing grounding system that do not comply with requirements of this section.
- B. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
  - 1. Drive ground rods until tops are **2 inches (50 mm)** below finished floor or final grade, unless otherwise indicated.
  - 2. Interconnect ground rods with grounding electrode conductors. Uses exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
  - 3. Install minimum 2 ground rods in main switchboard rooms along with a visible connection to the ground rods.
- C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- E. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, valves, or service unions. Connect to pipe with grounding clamp connectors.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. Metal Frame of the building where effectively grounded: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to metal frame of building. Exothermically weld grounding conductors to metal frame. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- I. Concrete encased steel reinforcing bar or rod in underground footings or foundations: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to reinforcing bar or rod. Exothermically weld grounding conductors to reinforcing bar or rod. Bond metal grounding conductor conduit or sleeve to conductor at each end.

### 3.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Non-contact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding

bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.5 SEPARATELY DERIVED SYSTEMS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of grounding electrode conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Do not ground system neutral conductor under any circumstances after it has been grounded at the service entrance disconnect except for separately derived systems. Interconnect or bond all grounding systems to the main system ground. Do not use neutral conductors for grounding equipment. Do not bond the neutral bus to distribution cabinets, except for separately derived systems.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
  - 3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
    - a. Equipment Rated 500 kVA and Less: 10 ohms.
  - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

## SECTION 16071 - SEISMIC CONTROLS FOR ELECTRICAL WORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

#### 1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.
- C. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.

#### 1.4 SUBMITTALS

- A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.
  - 1. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by an agency approved by authorities having jurisdiction.
- B. Shop Drawings: For anchorage and bracing not defined by details and charts on Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.
  - 1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
  - 2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and spacings, identifying components and listing their strengths. Indicate direction and value of forces transmitted to the structure during seismic events.
  - 3. Preapproval and Evaluation Documentation: By an agency approved by authorities having jurisdiction, showing maximum ratings of restraints and the basis for approval (tests or calculations).
- C. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.



- E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

## 1.5 QUALITY ASSURANCE

- A. Comply with seismic restraint requirements in IBC, unless requirements in this Section are more stringent.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.

## 1.6 PROJECT CONDITIONS

- A. Acceleration Factors: verify with project structural engineer.

## 1.7 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. B-Line Systems, Inc.
  - 3. Erico, Inc.
  - 4. GS Metals Corp.
  - 5. Loos & Company, Inc.
  - 6. Mason Industries, Inc,
  - 7. Powerstrut.
  - 8. Thomas & Betts Corp.
  - 9. Unistrut Corporation.

### 2.2 MATERIALS

- A. Use the following materials for restraints:
  - 1. Indoor Dry Locations: Steel, zinc plated.
  - 2. Outdoors and Damp Locations: Galvanized steel.
  - 3. Corrosive Locations: Stainless steel.

### 2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

## 2.4 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch (41-by-41-mm) cross section, formed from 0.1046-inch- (2.7-mm-) thick steel, with 9/16-by-7/8-inch (14-by-22-mm) slots at a maximum of 2 inches (50 mm) o.c. in webs, and flange edges turned toward web.
  - 1. Materials for Channel: ASTM A 570, GR 33.
  - 2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.
  - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
  - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
  - 1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
  - 2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.
  - 1. Install bracing parallel to trusses, beams, joints, bridging, etc.
- B. Install safety wires fastened to structure at diagonal corners of lighting fixtures for seismic support of fixtures mounted in or on grid type ceilings. Do not fasten to grid hangers or to grid hanger's point of support.

### 3.2 STRUCTURAL ATTACHMENTS

- A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.
- B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.
- C. Attachments to Existing Concrete: Use expansion anchors.
- D. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.
- E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.
- F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.
- G. Attachments to Wood Structural Members: Install bolts through members.
- H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

### 3.3 ELECTRICAL EQUIPMENT ANCHORAGE

- A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.
- B. Anchor panelboards, as follows:
  - 1. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.
  - 2. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
  - 3. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

### 3.4 SEISMIC BRACING INSTALLATION

- A. Install bracing according to spacings and strengths indicated by approved analysis.
- B. Expansion and Contraction: Install to allow for thermal movement of braced components.
- C. Cable Braces: Install with maximum cable slack recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

### 3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Test pull-out resistance of seismic anchorage devices.
  - 1. Provide necessary test equipment required for reliable testing.
  - 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
4. Obtain Architect's approval before transmitting test loads to the structure. Provide temporary load-spreading members.
5. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
6. Test to 90 percent of rated proof load of device.
7. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.
8. Record test results.

END OF SECTION 16071

## SECTION 16075 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

#### 1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

#### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

### PART 2 - PRODUCTS

#### 2.1 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
  - 1. Color: Black letters on orange field.
  - 2. Legend: Indicates voltage and service.
- B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.
- C. Colored Adhesive Tape: Self-adhesive vinyl tape not less than **3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide)**.
- D. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

#### 2.2 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum **1/16 inch (1.6 mm)** thick for signs up to **20 sq. in. (129 sq. cm)** and **1/8 inch (3.2 mm)** thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.

- C. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

## 2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: **3/16 inch (5 mm)**.
  - 2. Tensile Strength: **50 lb (22.3 kg)** minimum.
  - 3. Temperature Range: **Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C)**.
  - 4. Color: According to color-coding.
- B. Paint: Formulated for the type of surface and intended use.
  - 1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
  - 2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
  - 3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
  - 4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Install painted identification according to manufacturer's written instructions and as follows:
  - 1. Clean surfaces of dust, loose material, and oily films before painting.
  - 2. Prime surfaces using type of primer specified for surface.
  - 3. Apply one intermediate and one finish coat of enamel.
- F. Paint fire alarm junction boxes red.
- G. Circuit Identification Labels on Boxes: Install labels externally for all installed boxes prior to installation of conductors.
  - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
  - 2. Concealed Boxes: Plasticized card-stock tags.
  - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- H. Circuit Identification Labels on Plates: Install labels externally for all installed wiring device plates indicating panel and circuit number.
  - 1. Clear preprinted adhesive labels.
- I. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

- J. Color-Coding of Secondary Phase Conductors: Color code switch legs, travelers and other wiring for branch circuits other than those listed below. Permanently post color code at each branch panelboard. Use the following colors for service, feeder and branch-circuit phase conductors:
1. 208/120-V Conductors:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Neutral: White.
    - e. Ground: Green.
    - f. Insulated Ground: Green with white stripe.
  2. 480/277-V Conductors:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
    - d. Neutral: Gray.
    - e. Ground: Green.
  3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 6 AWG:
    - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
- K. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
1. Legend: **1/4-inch- (6.4-mm-)** steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
  2. Tag Fasteners: Nylon cable ties.
  3. Band Fasteners: Integral ears.
- L. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
  2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
  3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- M. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
  2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum **3/8-inch- (9-mm-)** high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
  3. Install caution signs for enclosures Over 600 V: Indicate system voltage on black, preprinted on orange field.
- N. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication,

signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high lettering on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high. Use white lettering on black field. Refer to labeling schedule for lettering and background colors for specialized labeling. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Interior and exterior of panelboards, electrical cabinets, and enclosures.
    - a. Distribution Panelboards: Identify Distribution Panelboard designation and circuit serving distribution panelboard; label main and distribution overcurrent protection showing load served and location (identify room numbers).
    - b. Branch Panelboards: Identify distribution panel and circuit serving panelboard.
    - c. Main Overcurrent Protection: Identify main device and service disconnects.
  2. Access doors and panels for concealed electrical items.
  3. Electrical switchboards.
  4. Disconnect switches.
    - a. Identify equipment designation, fla.
  5. Control devices.
- O. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.
1. Existing Panelboards: identify existing circuits as well as new circuits in new framed, typed circuit schedules.

END OF SECTION 16075



## SECTION 16120 - CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field Quality-Control Test Reports: From Contractor.

#### 1.4 QUALITY ASSURANCE

- A. Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

#### 2.2 CONDUCTORS AND CABLES

- A. Manufacturers:
  - 1. Copper Wire and Cables:
    - a. Alcan Aluminum Corporation; Alcan Cable Div.
    - b. American Insulated Wire Corp.; a Leviton Company.
    - c. General Cable Corporation.
    - d. Senator Wire & Cable Company.
    - e. Southwire Company.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

- C. Conductor Material: Copper, minimum size #12 for phase conductors and #14 for control conductors complying with NEMA WC 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
- D. Conductor Insulation Types: Type THWN-2 complying with NEMA WC 7.
- E. Multiconductor Cable: Metal-clad cable (Type MC), with ground wire.

## 2.3 CONNECTORS AND SPLICES

- A. Manufacturers:
  1. AFC Cable Systems, Inc.
  2. AMP Incorporated/Tyco International.
  3. Burndy.
  4. Hubbell/Anderson.
  5. IlSCO.
  6. O-Z/Gedney; EGS Electrical Group LLC.
  7. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THWN-2, single conductors in raceway. Exposed Branch Circuits, including in Crawlspace: Type THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THWN-2, single conductors in raceway.
- H. Class 1 Control Circuits: Type THWN-2, in raceway.
- I. Class 2 Control Circuits: Type THWN-2, in raceway.
- J. Fixture Conductors: Install conductors in lighting fixtures with insulation ratings as recommended by the manufacturer's written instructions or a minimum 90 degrees C., whichever is higher.
- K. Communication Conductors: Install communication conductors in raceway.

### 3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Multi-wire branch circuits: install no more than three circuits in a raceway, unless specifically shown otherwise. Install #10 conductors for branch circuits for which the distance from panelboard to furthest outlet is more than 100' for 120 volt or more than 140' for 277 volt circuits.
- C. GFI circuit breakers or feed-thru outlets to outlets served: provide separate neutrals.
- D. Panelboards, switchboards, MCCs, switchgear: Do not route conductors through a section which terminate in another section, except for interconnecting control conductors.
- E. Remove existing conductors from raceway before pulling in new wires and cables.
- F. Parallel conductors: Where parallel conductors are installed in parallel raceways, install in each raceway conductors of phase, neutral and/or ground as specified. Carefully cut parallel conductors to identical length for each phase leg. Do not parallel conductors less than #1/0.
- G. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- H. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- I. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- J. Do not install wiring through any part of a transformer vault or elevator equipment room and shaft that is does not serve equipment in the respective room. Also, coordinate that piping or other items foreign to the transformer vault, elevator equipment room or shaft is not installed in these spaces.
- K. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- L. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."
- M. Identify and color-code conductors and cables according to Division 16 Section " Electrical Identification."

### 3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Conductor splices: Minimize conductor splices. Do not install in conduit bodies.
- C. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors. Install compression type connectors for aluminum conductors or copper pigtail adapters for installation in mechanical lugs.

- D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
- E. Furniture connections: connect systems furniture to power supply circuits per manufacturer's written instructions.
- F. Panelboard connections: do not splice conductors in panelboards.

#### 3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
  - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 16120

## SECTION 16130 - RACEWAYS AND BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
  - 2. Division 16 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. LFNC: Liquidtight flexible nonmetallic conduit.
- F. RNC: Rigid nonmetallic conduit.

#### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## 1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 METAL CONDUIT AND TUBING

- A. Manufacturer:
  - 1. AFC Cable Systems, Inc.
  - 2. Alfex Inc.
  - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 4. Electri-Flex Co.
  - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  - 6. LTV Steel Tubular Products Company.
  - 7. Manhattan/CDT/Cole-Flex.
  - 8. O-Z Gedney; Unit of General Signal.
  - 9. Wheatland Tube Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- E. Plastic-Coated IMC and Fittings: NEMA RN 1.
- F. EMT and Fittings: ANSI C80.3.
  - 1. Fittings: Steel Set-screw or compression type. Do not use die-cast fittings.
- G. FMC: Zinc-coated steel.
- H. LFMC: Flexible steel conduit with PVC jacket.
- I. Fittings: NEMA FB 1; compatible with conduit and tubing materials. Do not use die-cast fittings.

### 2.3 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturer:
  - 1. American International.

2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe & Plastics Group.
6. Condux International.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; Division of Hubbell, Inc.
12. Spiraldut, Inc./AFC Cable Systems, Inc.
13. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

D. LFNC: UL 1660.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturer:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

## 2.5 EXPANSION FITTINGS:

A. Manufacturer:

1. O-Z Gedney; Unit of General Signal.

- B. Expansion Fittings: Malleable Iron, hot dipped galvanized, weatherproof suitable for raceway and applications
  - 1. Coordinate expansion requirements with Architect.

## 2.6 FACTORY FINISHES

- A. Finish: provide manufacturer's standard paint applied before shipping to factory-assembled products for:
  - 1. Surface raceways: Paint to match wall color.
  - 2. Enclosures: Standard Grey in electrical rooms, White in finished areas.
  - 3. Cabinets: Standard Grey in electrical rooms, White in finished areas.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors:
  - 1. Exposed: Rigid steel or IMC.
  - 2. Concealed: Rigid steel or IMC.
  - 3. Underground, Single Run: RNC (except coated or wrapped rigid steel for bends greater than 22 degrees), coated or wrapped rigid steel.
  - 4. Underground, Grouped: RNC (except coated or wrapped rigid steel for bends greater than 22 degrees), coated or wrapped rigid steel.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 6. Boxes and Enclosures: NEMA 250, Type 3R.
- B. Indoors:
  - 1. Exposed:
    - a. Above 6' from finished floor: EMT, IMC, or Rigid Steel.
    - b. Below 6' from finished floor, or subject to mechanical damage: IMC, or Rigid Steel.
  - 2. Underground: refer to underground installation selections in outdoor paragraph above.
  - 3. Concealed: EMT, or Rigid Steel.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Damp or Wet Locations: Rigid steel conduit.
  - 6. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
    - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
- C. Minimum Raceway Size:
  - 1. Metallic Conduits: 3/4-inch trade size (DN 21) except 1/2" C trade size (DN 16) for low voltage automatic temperature control or motor control wiring.
  - 2. Nonmetallic Conduits: 3/4-inch trade size (DN 21).
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid Metal Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated. Engage a minimum of five full threads.
  - 2. Intermediate Metal Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated. Engage a minimum of five full threads.
  - 3. PVC Externally Coated or wrapped Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
  - 4. EMT: set screw or compression for dry interior locations; compression for damp or wet locations; compression with tape for installations in concrete slabs above grade.



5. Building Expansion joints: use expansion fittings with 36" of wrapped metal raceways on either side of joint.
- E. Do not install aluminum conduits embedded in or in contact with concrete.

### 3.2 INSTALLATION

- A. Layout of electrical boxes: Do not scale electrical drawings.
  1. Coordinate with architectural elevations. Where outlets are not identified on the elevations, refer mounting height decisions to the Architect. If counters or work surfaces are shown refer mounting height decisions, whether above or below counter, to the Architect. Coordinate location of switches with actual door swings.
  2. Verify final locations with field measurements and with the requirements of the actual equipment to be connected as determined from shop drawings.
  3. Mounting heights indicated on the drawings for wall mounted lighting fixtures are to the center of the lighting fixture.
  4. Mounting heights indicated on the drawings for pendant mounted lighting fixtures are to the bottom of the lighting fixture.
  5. Mechanical and equipment rooms. Coordinate location of lighting and power outlets with duct and equipment locations. Do not install outlets behind equipment or where otherwise inaccessible. Position lighting, regardless of where shown on drawings, to provide proper illumination.
  6. Mount outlet boxes for switches and receptacles with the long axis of the device vertical unless otherwise indicated.
  7. Set boxes with plaster-rings flush with finished surface.
  8. Install boxes on opposite sides of wall with a stud and a minimum 10" between them.
  9. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally.
- B. Outlet Boxes:
  1. Frame construction: 4"X4"X1-1/2" with suitable plaster-ring, except:
    - a. 2-1/8" deep for boxes with 3 conduit entrances or for communication outlets
    - b. 4-11/16" boxes for boxes with 4 or more conduits.
  2. Masonary or concrete construction: 1g or multiple gang by 3-1/2" deep.
  3. Fixture Outlets: minimum 4" outlet box with 3/8" fixture stud supported adequately for minimum of 200 lbs.
  4. Do not use gangable boxes.
- C. Keep raceways at least 12 inches (300 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- D. Complete raceway installation before starting conductor installation.
- E. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
- F. Install temporary closures to prevent foreign matter from entering raceways.
- G. Stub-ups: Embed coupling flush with finished floor. If to remain a spare, the flush plug is to remain in the coupling.
- H. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated. Make bends in parallel or banked runs from same centerline to make bends parallel.
  1. Nonmetallic Conduits: Use rigid elbows for all bends 22 degrees or greater.

2. Communication Systems Raceways: comply with long sweep radius elbows minimum dimensions in Table 5.2-1 of ANSI/TIA/EIA-569A for all bends or offsets for backbone cables.
- I. Raceways below grade: Install RNC or wrapped/coated Rigid Steel minimum 24" below grade, unless specifically noted otherwise. Where noted encase in concrete.
- J. Conceal conduit and EMT within finished walls, ceilings, and floors, except at surface mounted panels and apparatus or unless otherwise indicated. Install surface raceways only where indicated or where directed by Architect.
  1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
  2. Install surface raceways in rooms where surface mounted panels are indicated or for exposed equipment in mechanical, electrical, or communication rooms.
- K. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
  1. Maximum conduit size: Lesser of 1-inch trade size (DN 27) or 1/3 the concrete cover.
    - a. For conduits larger than 1-inch trade size (DN 27), consult structural engineer for additional structural supports or other options.
  2. Layout: Route conduits without crossovers. Space conduit at least 18" apart. Space raceways laterally to prevent voids in concrete.
    - a. Where concentrations of conduit occur, support slab independent of steel deck. Coordinate with structural engineer.
  3. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  4. Install taped compression type fittings or fittings approved for such use.
  5. Change from nonmetallic tubing to rigid steel conduit before rising above the floor.
- L. Raceways Penetrating foundation walls: Install rigid conduit through the foundation wall or 3' each side.
- M. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  1. Run parallel or banked raceways together on common supports.
  2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Join raceways with fittings designed and approved for that purpose and make joints tight.
  1. Use insulating bushings to protect conductors.
- O. Tighten set screws of threadless fittings with suitable tools.
- P. Cap open ends of empty conduit to keep out debris until the project is completed.
- Q. Terminations:
  1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. For RMC and IMC, use two locknuts, one inside and one outside box and a bushing. For EMT, use insulated throats or plastic bushings (except for grounding bushings where required).
  2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

3. Service Conduits or conduits installed in concentric/eccentric knock-outs or reducing washers: terminate raceway with grounding bushings.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of pull wire. Plug empty raceways at both ends.
  - S. Low Voltage, Telephone, and Signal System Raceways, **2-Inch Trade Size (DN 53)** and Smaller: In addition to above requirements, install raceways in maximum lengths of **150 feet (45 m)** and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
  - T. Install seals for conduit penetrations of slabs on grade and exterior walls below grade. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.
  - U. Roof Penetrations: Install flashings for conduit penetrations of roofs under the direct supervision of the roofing installer.
  - V. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
    1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    2. Where conduits pass through airtight spaces or plenums to prevent air leakage.
    3. Where conduits pass from hazardous areas to nonhazardous.
    4. Where otherwise required by NFPA 70.
  - W. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used **6 inches (150 mm)** above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
  - X. Raceway Cleaning: Prevent accumulation of water, dirt or concrete in raceways. Where water or foreign matter have entered raceways, thoroughly clean or replace conduits where such accumulation cannot be removed by methods approved by this Engineer.
  - Y. Flexible Connections: Use maximum of **72 inches (1830 mm)** of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
  - Z. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
  - AA. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- ### 3.3 PROTECTION
- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
    1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

#### 3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 16130

## SECTION 16140 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Single and duplex receptacles, ground-fault circuit interrupters.
  - 2. Device wall plates.
  - 3. Special purpose receptacles.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Field quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

### PART 2 - PRODUCTS

#### WIRING DEVICES

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Wiring Devices:
    - a. Bryant Electric, Inc./Hubbell Subsidiary.
    - b. Eagle Electric Manufacturing Co., Inc.
    - c. Hubbell Incorporated; Wiring Device-Kellems.
    - d. Leviton Mfg. Company Inc.
    - e. Pass & Seymour/Legrand; Wiring Devices Div.

## 2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.
  - 1. Thermoplastic face.
  - 2. Thermoset base.
  - 3. Back and side wired.
  - 4. Rating: 20 A minimum
- B. Straight-Blade (30 A thru 50A) and Locking Receptacles: Heavy -Duty grade.
- C. GFCI Receptacles: Straight blade, feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a ~~2-3/4-inch-~~ (70-mm-) deep outlet box without an adapter.

## 2.3 SWITCHES

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
  - 1. Rating: Minimum 20A.
  - 2. Thermoplastic face.
  - 3. Thermoset base.
  - 4. Back and side wired.

## 2.4 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish, except screwless devices for locations where only dimmers are shown.
  - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
  - 3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
  - 4. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
  - 5.

## 2.5 FINISHES

- A. Color:
  - 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Install wall dimmers with capacity to achieve 60% of circuit loads indicated on drawings after derating for ganging according to manufacturer's written instructions.
- C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.
- D. Install control wiring for electronic fluorescent dimmers (low voltage or line voltage) per manufacturers written instructions.
- E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- F. Wallplates and coverplates: install wallplates and coverplates for all outlets, including blank outlets.
- G. GFI Devices: Install separate GFCI devices, except where installed under the same multi-gang plate.
- H. Remove wall plates and protect devices and assemblies during painting.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- J. Install cord and plug sets for appliances, mechanical equipment, and other equipment per manufacturer's written instructions.

### 3.2 IDENTIFICATION

- A. Comply with Division 16 Section "Electrical Identification."
  - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with color-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
    - a. Black letters on light colored plates.
    - b. White on dark colored plates.

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
  - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 16140



**Standard Wiring Device Schedule**

Note to Bidders: Comply with Section 16140 of the specifications. The catalog numbers listed below have been carefully prepared with the assistance of the manufacturer's representatives with the objective of assisting the bidders in determining the quality and ratings of the wiring device specified; however, the catalog numbers may not be complete or accurate. In addition, the color of the wiring device is not intended to be determined by the catalog numbers listed below, but shall be selected by the Architect as indicated in the specification. Each manufacturer prior to bidding shall compare catalog numbers shown with the description and shall notify the Architect/Engineer of any discrepancies.

NEMA	DESCRIPTION	CATALOG NUMBERS
NEMA 5-20R	20A, 125V 2 pole 3 wire duplex grounding receptacles. Nylon or Lexan Faces. Back and side wired. Comply with FS W-C-596 and UL 498.	Bryant 5352 Hubbell CR5352 Leviton 5352 P&S 5352
NEMA 5-20R GFCI	20A, 125V 2 pole 3 wire duplex feed thru GFCI receptacles with indicator light. Nylon or Lexan decorator faces. Back and side wired. Internal components shall comply with FS W-C-596 where applicable. Comply with UL 498 and UL 493.	Bryant GFR53FT Hubbell GF5352 Leviton 6898 P&S 2091 S
NEMA 5-20R Waterproof (Weatherproof in use)	20A, 125V 2 pole 3 wire duplex grounding receptacles. Nylon or Lexan Faces. Back and side wired. Comply with FS W-C-596 and UL 498. Fully gasketed weatherproof while in use enclosure.	Hubbell CR5352/5051-0
NEMA 5-20R Weatherproof	20A, 125V 2 pole 3 wire duplex grounding receptacles. Nylon or Lexan Faces. Back and side wired. Comply with FS W-C-596 and UL 498. Cast aluminum and UL listed for wet locations.	Hubbell HBL5206WO

## SECTION 16145 - LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following lighting control devices:
  - 1. Indoor occupancy sensors.
- B. Related Sections include the following:
  - 1. Division 16 Section "Wiring Devices" for wall-box dimmers and manual light switches.

#### 1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.
- C. US: Ultrasonic.
- D. DT: Dual Technology

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
  - 2. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

### PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

## 2.3 INDOOR OCCUPANCY SENSORS

- A. Manufacturers:
  - 1. Hubbell Lighting Inc.
  - 2. Lithonia Lighting.
  - 3. Novitas, Inc.
  - 4. Sensor Switch, Inc.
  - 5. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
  - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  - 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
  - 4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted though a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  - 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  - 6. Bypass Switch: Override the on function in case of sensor failure.
- C. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
  - 1. Ultrasonic Detector only permitted where indicated on the drawings or where prior approval is given in response to shop drawings.
  - 2. Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
  - 3. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
  - 4. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on an 8-foot- (2.4-m-) high ceiling.
  - 5. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
  - 6. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

- D. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
  - 1. Sensitivity Adjustment: Separate for each sensing technology.
  - 2. Detector Sensitivity: Detect occurrences of **6-inch (150-mm)** minimum movement of any portion of a human body that presents a target of at least **36 sq. in. (232 sq. cm)**, and detect a person of average size and weight moving **at least 12 inches (305 mm)** in either a horizontal or a vertical manner at an approximate speed of **12 inches/s (305 mm/s)**.
  - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of **1000 sq. ft. (93 sq. m)** when mounted on a **96-inch- (2440-mm-)** high ceiling.

## 2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 16 Section "Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 16 Section "Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 16 Section "Conductors and Cables."
- D. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Division 16 Section "Voice and Data Communication Cabling."

## PART 3 - EXECUTION

### 3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

### 3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 16 Section "Conductors and Cables." Minimum conduit size shall be **3/4 inch (20 mm)**.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 16 Section " Electrical Identification."
- B. Label time switches and contactors with a unique designation.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.5 COMMISSIONING

- A. Manufacturer Commissioning: obtain the services of the manufacturer of the occupancy sensors to test and adjust each sensor for the application to eliminate false operation.
- B. Relocate sensors as required to eliminate false operation.
- C. Replace defective or inappropriate sensors with sensors suitable for the function intended.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
  - 1. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and preventative maintenance. Provide minimum of three hours' training.
  - 2. Training Aid: Use the approved final version of maintenance manuals as a training aid.
  - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

### 3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 16145

## SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
  - 1. Motor and equipment disconnecting means.
- B. Related Sections include the following:
  - 1. Division 16 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
  - 2. Division 16 Section "Fuses" for fusible devices.

#### 1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.
- D. MCP: Motor Circuit Protectors (Adjustable instantaneous trip circuit breakers).

#### 1.4 SUBMITTALS

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switch and circuit breaker.
  - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations and layout of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Current and voltage ratings.
    - c. Short-circuit current rating.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:
  - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- E. Field Test Reports: Submit written test reports and include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Manufacturer's field service report.
- G. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
  - 1. Routine maintenance requirements for components.
  - 2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
  - 3. Time-current curves, including selectable ranges for each type of circuit breaker.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA AB 1 and NEMA KS 1.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not less than **minus 22 deg F** (**minus 30 deg C**) and not exceeding **104 deg F** (**40 deg C**).
  - 2. Altitude: Not exceeding **6600 feet** (**2000 m**).

## 1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Fusible Switches:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Control Division.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.

## 2.2 ENCLOSED SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.
  - 1. Rejection clips where rejection fuses are specified.

## 2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.

## 2.4 FACTORY FINISHES

- A. Finish: Manufacturer's standard gray paint applied to factory-assembled and -tested enclosures before shipping.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Equipment Disconnects
  - 1. Maximum elevation: 48".
  - 2. Locate lockable disconnect near each motor complying with clearance requirements.
  - 3. Multiple speed motors: provide switch in all motor leads.

## 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."



- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- C. Fusible Switch Labels: Label each enclosure with "REPLACE WITH CURRENT LIMITING FUSES ONLY. CATALOG NUMBER: (FUSE CAT. NO.)."

### 3.4 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
  - 2. Test continuity of each line- and load-side circuit.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### 3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16410

## SECTION 16442 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
  - 1. Lighting and appliance branch-circuit panelboards.
  - 2. Distribution panelboards.
- B. Related Sections include the following:
  - 1. Division 16 Section "Seismic Controls for Electrical Work."

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. TVSS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. Layout of overcurrent devices in panelboard.
    - e. UL listing for series rating of installed devices.
    - f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

- C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:
  - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. The term "withstand" means "the unit will remain in place without separation of internal and external parts during a seismic event."
  - 3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- E. Field Test Reports: Submit written test reports and include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

#### 1.7 EXTRA MATERIALS

- A. Keys: Six spares of each type of panelboard cabinet lock.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Control Div.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.

### 2.2 FABRICATION AND FEATURES

- A. Enclosures: Flush- and surface-mounted cabinets as indicated on the drawings. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- E. Bus: Hard-drawn copper, 98 percent conductivity.
- F. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.
- G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- H. Insulated Equipment Ground Bus: Adequate for feeder and branch-circuit equipment insulated ground conductors; insulate from box.
- I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- J. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
- K. Feed-through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

### 2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

### 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

- B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.5 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
- B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Examine areas where panelboards are planned to be installed. Coordinate with other installers so that installation complies with NEC 110-26.
  - 1. Do not locate panelboards so that the door swing swings through the clear area.

### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."
- C. Mounting Heights: Top of trim **74 inches (1880 mm)** above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Circuit Directory: Create a directory to indicate installed circuit loads showing locations (final room numbers as determined by user) and use. Obtain approval for room numbers to be used before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
  - 1. Existing Panelboards: verify existing circuits and create new circuit directory.
- F. Install filler plates in unused spaces.
- G. Provision for Future Circuits at Flush Panelboards: Stub six **1-inch (27-GRC)** empty conduits from panelboard section into accessible ceiling space or space designated to be ceiling space in the future. Stub five **1-inch (27-GRC)** empty conduits into raised floor space or below slab not on grade.
- H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- C. Phase Conductor Color Code Identification: Permanently post at each branch-circuit panelboard the color coding scheme for phase conductors of all voltages used in the project.

### 3.4 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### 3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442

## SECTION 16491 - FUSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes cartridge fuses, rated 600 V and less, for use in switches, panelboards, switchboards, controllers, and motor-control centers; and spare fuse cabinets.

#### 1.3 DEFINITIONS

- A. RK1-TD: Class RK1, Time Delay
- B. RK5-TD: Class RK5, Time Delay

#### 1.4 SUBMITTALS

- A. Product Data: Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings for each fuse type indicated.
- B. Product Data: Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 2. Let-through current curves for fuses with current-limiting characteristics.
  - 3. Time-current curves, coordination charts and tables, and related data.
  - 4. Fuse size for elevator feeders and elevator disconnect switches.
- C. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 1.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Provide fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

#### 1.6 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (4.4 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

#### 1.7 COORDINATION

- A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged in original cartons or containers and identified with labels describing contents.
  - 1. Fuses: Quantity equal to 10 percent of each fuse type and size, but not fewer than 3 of each type and size.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Industries, Inc.; Bussmann Div.
  - 2. Gould Shawmut.
  - 3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FUSE APPLICATIONS

- A. Refer to drawings for fuse types and sizes.
  - 1. Motor fuse sizes: Field select motor fuse sizes using the class of fuse shown on the drawings and sizing the fuse based upon the motor nameplate information and by multiplying by 1.25 (except for special service motors).

### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

### 3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 16491